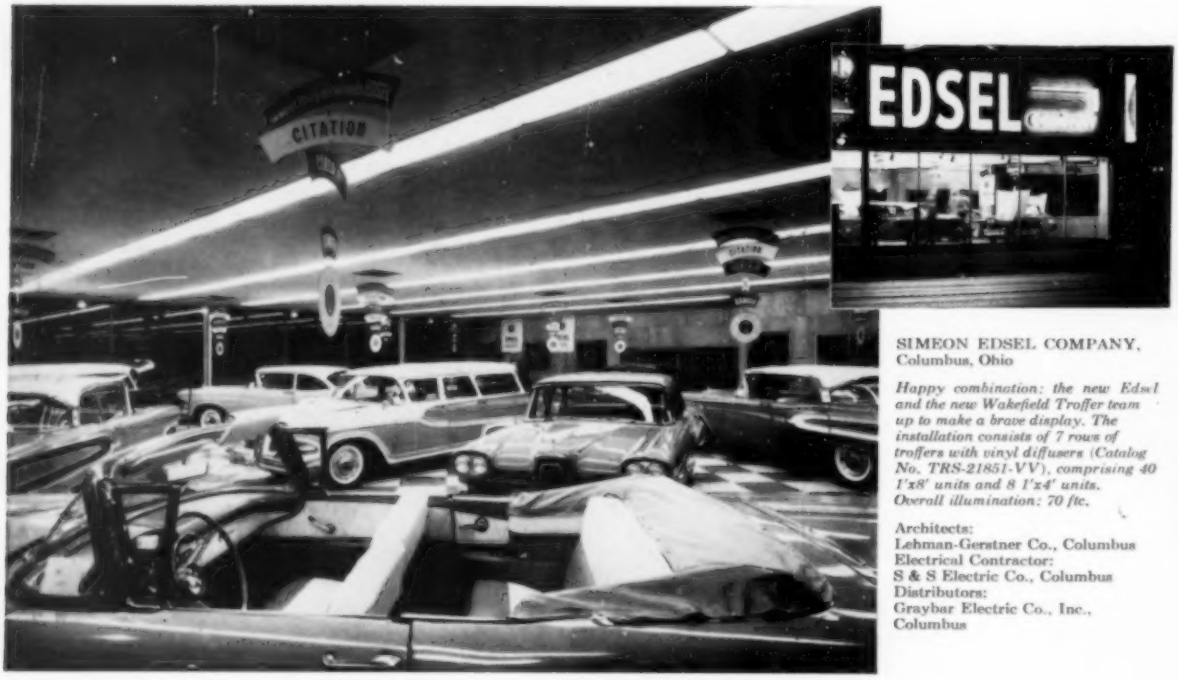
DECEMBER 1957

ie

ILLUMINATING ENGINEERING

Journal of the
ILLUMINATING ENGINEERING SOCIETY

You can do practically anything with a **WAKEFIELD TROFFER**



SIMEON EDSEL COMPANY, Columbus, Ohio

Happy combination: the new Edsel and the new Wakefield Troffer team up to make a brave display. The installation consists of 7 rows of troffers with vinyl diffusers (Catalog No. TRS-21851-VV), comprising 40 1'x8' units and 8 1'x4' units. Overall illumination: 70 ftc.

Architects:
Lehman-Gerstner Co., Columbus
Electrical Contractor:
S & S Electric Co., Columbus
Distributors:
Graybar Electric Co., Inc., Columbus

it comes in 4 modular sizes

• 1 ft. x 4 ft. • 1 ft. x 8 ft. • 2 ft. x 4 ft. • 2 ft. x 2 ft.

it offers 7 types of light control

• Styrene • 35° x 35° Louver • #70 Corning • Acrylic • Vinyl
• Alba-Lite No. 93 • Clear Plastic Lens

it fits 5 types of ceiling construction

• Acoustical ceilings using concealed mechanical suspension • Suspended plaster ceilings with plaster frames • Metal panel acoustical ceilings using Tee-bar suspension • Acousti-Line Ceilings • Acoustical ceilings using exposed grid suspension

A new Wakefield condensed catalog illustrates and describes the wonderful Wakefield Troffer line in detail. Write for your copy.

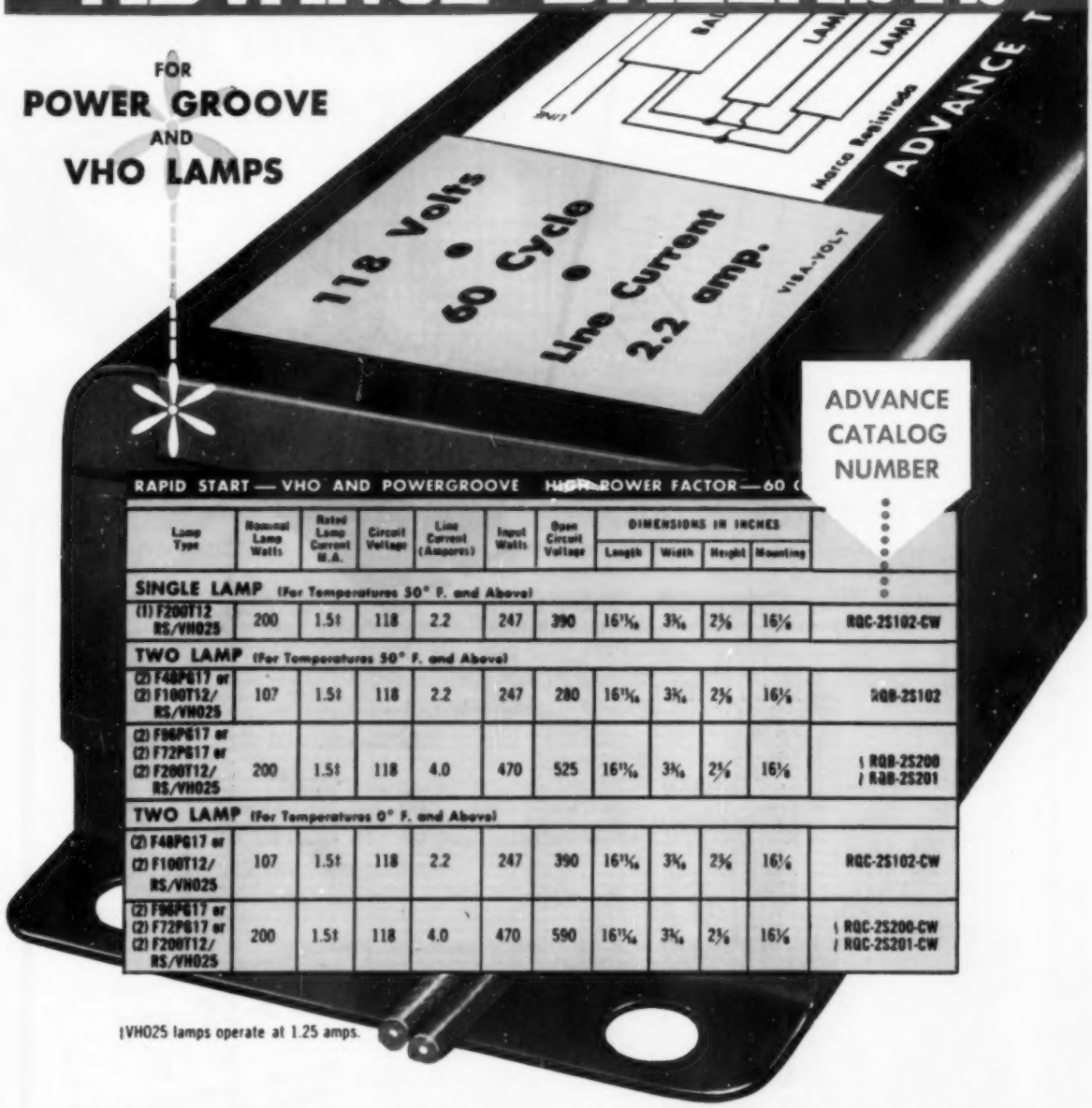
OFFICES IN 43 PRINCIPAL CITIES
IN THE U. S. AND CANADA

WAKEFIELD

THE WAKEFIELD COMPANY • VERMILION, OHIO
WAKEFIELD LIGHTING LIMITED • LONDON, ONTARIO

ADVANCE BALLASTS

FOR
POWER GROOVE
AND
VHO LAMPS



RAPID START — VHO AND POWERGROOVE HIGH POWER FACTOR — 60 C

Lamp Type	Nominal Lamp Watts	Rated Lamp Current M.A.	Circuit Voltage	Line Current (Amperes)	Input Watts	Open Circuit Voltage	DIMENSIONS IN INCHES Length	Width	Height	Mounting	ADVANCE CATALOG NUMBER
SINGLE LAMP (For Temperatures 50° F. and Above)											
(1) F200T12 RS/VHO25	200	1.5†	118	2.2	247	390	16 13/16	3 3/16	2 3/8	16 1/8	RQC-2S102-CW
TWO LAMP (For Temperatures 50° F. and Above)											
(2) F48PG17 or (2) F100T12/ RS/VHO25	107	1.5†	118	2.2	247	280	16 13/16	3 3/16	2 3/8	16 1/8	RQB-2S102
(2) F96PG17 or (2) F72PG17 or (2) F200T12/ RS/VHO25	200	1.5†	118	4.0	470	525	16 13/16	3 3/16	2 3/8	16 1/8	RQB-2S200 / RQB-2S201
TWO LAMP (For Temperatures 0° F. and Above)											
(2) F48PG17 or (2) F100T12/ RS/VHO25	107	1.5†	118	2.2	247	390	16 13/16	3 3/16	2 3/8	16 1/8	RQC-2S102-CW
(2) F96PG17 or (2) F72PG17 or (2) F200T12/ RS/VHO25	200	1.5†	118	4.0	470	590	16 13/16	3 3/16	2 3/8	16 1/8	RQC-2S200-CW / RQC-2S201-CW

†VHO25 lamps operate at 1.25 amps.

ADVANCE now offers a complete new line of ballasts for utilizing the maximum light output of VHO and Power-Groove fluorescent lamps. These ballasts have been specifically designed to give cooler, quieter and more efficient operation of these new lamps.

ADVANCE VHO and Power-Groove ballasts are the result of continuous research by our Product Engineering Department to design compact ballasts for lighting fixtures and still maintain the high quality you expect of ADVANCE ballasts. Send for details.

The Heart of the Lighting Industry

ADVANCE

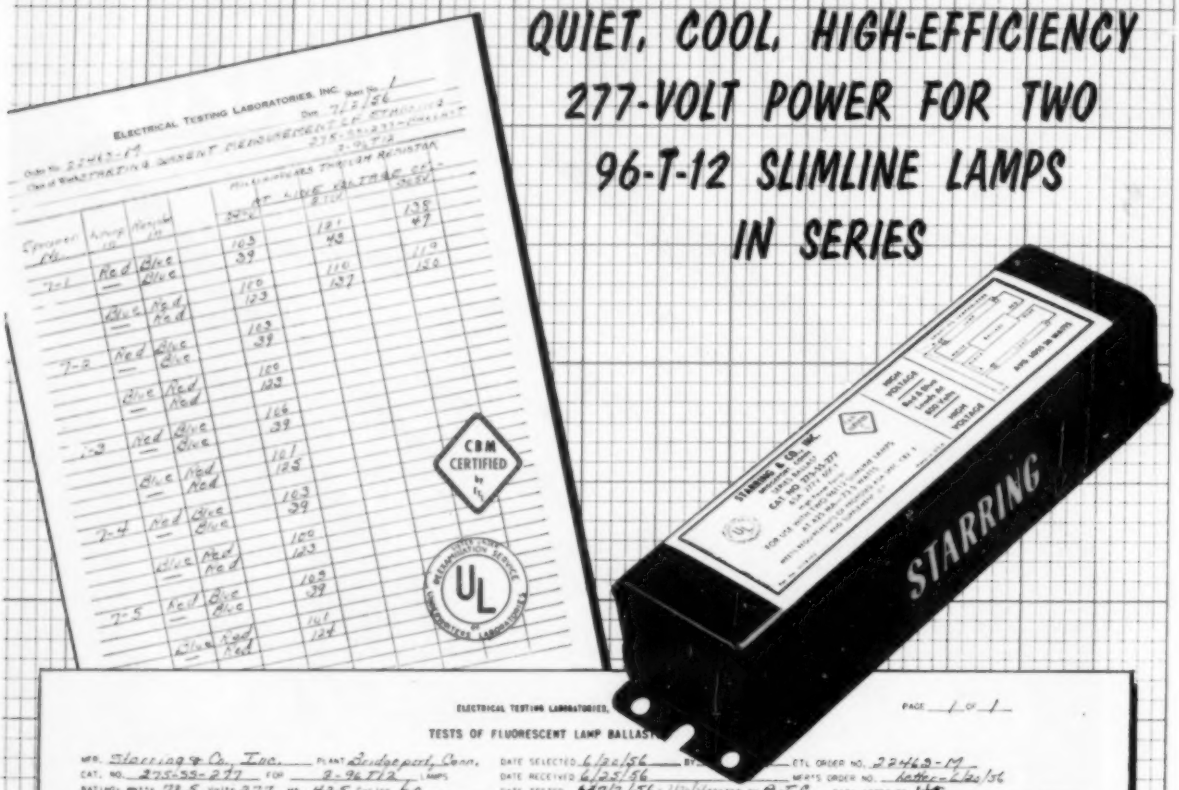
CBM CERTIFIED

World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

QUIET, COOL, HIGH-EFFICIENCY 277-VOLT POWER FOR TWO 96-T-12 SLIMLINE LAMPS IN SERIES



275-SS-277

11¾" x 3⅛" x 2⅝"
Mounting Length 11⅛"
Weight 10.8 pounds
Packed 6 per carton

STARRING & COMPANY, INC.

1600 SEAVIEW AVENUE • BRIDGEPORT 8, CONNECTICUT

EDison 4-0108

ie

ILLUMINATING ENGINEERING

THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

December 1957

Vol. LII, No. 12

1957-1958 Officers

President
Kirk M. Reid

Vice-President
George J. Taylor

Vice-President
J. B. Browder

General Secretary
R. G. Slauer

Treasurer
J. R. Chambers

•

Editor
Ruby Redford

•

Advertising Manager
Clayton E. Ellis

•

Assistants
Barbara Lamson, Editorial
Adelaide Philiba, Advertising

•

Publications Committee
R. M. Zabel, Chairman
J. R. Chambers
Brooks Chassaing
H. F. Davidson
R. W. Morris
J. S. Schuchert

•

Executive Secretary
A. D. Hinckley

Technical Director
C. L. Crouch

Contents

611 A Church Relighted — Werner F. Rosacker

613 Control — The Key to Modern Residence Lighting — Ed Schnoll

615 Calculating Coefficients for a Church Dome — Harold Strahn

616 Contemporary Methods Relight a Nineteenth-Century Library — R. W. Benjamin and Joseph Barney

619 Stair Lighting — Jack H. Murrah

621 Highway Visibility in Fog — Charles Marsh

628 Discussion — Application of Non-Circular Cross Section Fluorescent Lamps, by G. R. Baumgartner, R. T. Dorsey, and E. A. Linsday (paper published November 1957)

629 Discussion — Fluorescent Strip Runway Lighting, by S. C. Peek (paper published October 1957)

630 Effective Intensity of Flashing Lights — Theodore H. Projector

641 Computation of the Effective Intensity of Flashing Lights — Charles A. Douglas

647 I.E.S. Home Lighting Data Sheet
Lighting Wooden Shelves (22-60)

649 The General Secretary Reports — Richard G. Slauer

7A Lighting News
Here and There with I.E.S. Members, 8A; Scheduled Events, 9A; About People, 14A; Books and Pamphlets, 46A; New Members, 48A.

18A Committee Personnel

23A My Most Interesting Lighting Job Contest

55A Index to Advertisers

Sustaining Members — Refer to September 1957 ILLUMINATING ENGINEERING.

STATEMENTS and opinions in articles and papers in ILLUMINATING ENGINEERING are the expressions of contributors and do not necessarily represent the policies or opinions of the Society. Official Society opinions are expressed only in official committee reports specifically approved by the Council of the Illuminating Engineering Society.

ILLUMINATING ENGINEERING SOCIETY

EDITORIAL and advertising offices
1860 Broadway, New York 23, N. Y.

PUBLICATION office 32d Street & Elm Avenue, Baltimore 11, Md.

Founded 1906

ILLUMINATING ENGINEERING: The Journal of the Illuminating Engineering Society. Copyright 1957 by the Illuminating Engineering Society. Published monthly in the United States of America. Entered as second-class matter at the Post Office, Baltimore, Md. Acceptance for mailing at special postage rates provided for in Section 1103 P.L.&R., Act of October 3, 1917. Authorized July 16, 1918. ¶ Subscription $12 per year plus extra postage to all countries to which second-class postage rates do not apply; single copies $1.00. ¶ Address changes must be received at I.E.S. headquarters by the first of the month to be effective with the issue of the next succeeding month.

All 4 offer more light—save more money because Sylvania puts the reflector inside

Regardless of your lighting requirements —there's a Sylvania reflector lamp that can help reduce your lighting costs.

Sylvania reflector lamps give you more usable light without increasing power costs. You eliminate frequent, costly reflector and fixture cleaning expense. You get a higher degree of efficiency because light-dimming dirt, dust and grime can't affect the sealed-in reflector.

Sylvania reflector lamps are available in all 3 major lamp types:

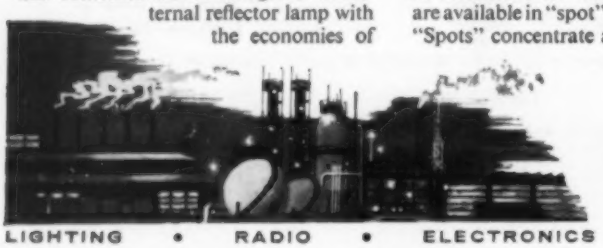
Mercury Vapor (KS-HI) — a highly efficient 400 w. Silver-White lamp that combines the advantages of an internal reflector lamp with the economies of mercury vapor lighting. Its 23,000 lumens represent an important increase of over 20% in light output compared to other types of mercury vapor lamps of the same wattage.

Fluorescent—You get up to 60% more directed, usable light with Sylvania's Reflector Fluorescent Lamp. Available in single-pin and bi-pin types, they are made in a broad range of colors and sizes. They are particularly suited for industrial lighting, for bare-lamp strip lighting, and directed light in store windows, coves, valances, etc.

Incandescent — Sylvania Incandescent Reflector and Projector Lamps are available in "spot" and "flood" types. "Spots" concentrate a beam of high intensity, while "floods" give a wider, more diffused beam. Reflector lamps are suitable for high-bay industrial lighting, and close visual assembly work, parking areas, etc. Projector lamps are better for area floodlighting and general outdoor applications, or for interior industrial auxiliary lighting and many commercial applications.

Let your Sylvania Supplier demonstrate the dollars-and-cents advantages of high-efficiency reflector lamp lighting. Call him today, or write for information to:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. 7L-3512
60 Boston Street, Salem, Mass.
In Canada: Sylvania Electric (Canada) Ltd.
Shell Tower Building, Montreal



SYLVANIA

. . . the fastest growing name in sight!

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

Anticipation . . .

the heart

of creation

Trust Dept. First National Bank, Chicago, Illinois.

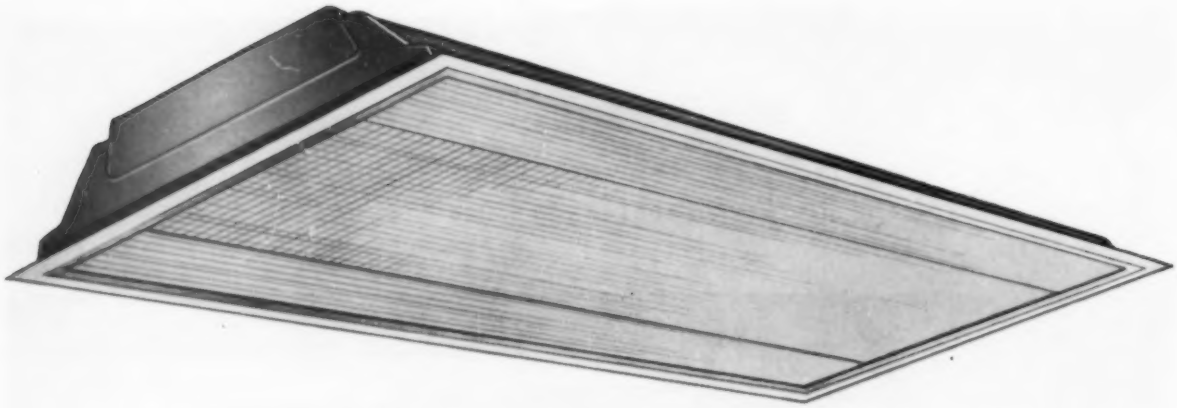
From the foresight of Curtis Visioneers comes the New Eye Comfort Troffer with L.B.Q.*

A 60-year history of developing new advancements in planned lighting must be respected. Not surprising, then, that credit for the exclusive Eye Comfort® Troffer with *low-brightness quality goes to Curtis visioneers. Who are the Curtis visioneers? Vision-engineers. Illuminating engineers who scientifically plan, design, manufacture and oversee installation of lighting systems that assure visual acuity, provide visual comfort, under any conditions. They are engineers not only of vision but *with* vision. The vision to pioneer with innovations like the revolutionary new Curtis Eye Comfort Alzak Aluminum Troffer . . . first luminaire to have a *true parabolic-shaped fin* of heaviest gauge aluminum—the extruded L.B.Q. louver. Result is high level illumination . . . shadowless low-brightness quality . . . wherever light is cast. Meets the demands, too, of those who specify and buy fluorescent lighting for *quality illumination—long-run* economy. Write today for the name and address of the Curtis representative in the principal city nearest you. Curtis Lighting Inc., 6135 W. 65th Street, Chicago 38, Ill. In Canada: 195 Wicksteed Ave., Toronto 17.

CURTIS EYE COMFORT ALZAK ALUMINUM L.B.Q. TROFFER WITH L.B.Q. LOUVER FIN.
Snap-on yoke and toggle bolts for easy application to any type ceiling. Uninterrupted wireway. No nipples required. New shallow depth . . . maximum recessing space required, only 6¼".

CURTIS

Visioneers in Planned Lighting®



New Day-Brite Mobilex® for modular ceilings

INTRODUCING A NEW MOBILEX . . . available now! Superb expression of the modular concept. Available in five basic fixture types . . . pioneered by Day-Brite . . . compatible with 97 different ceiling systems.

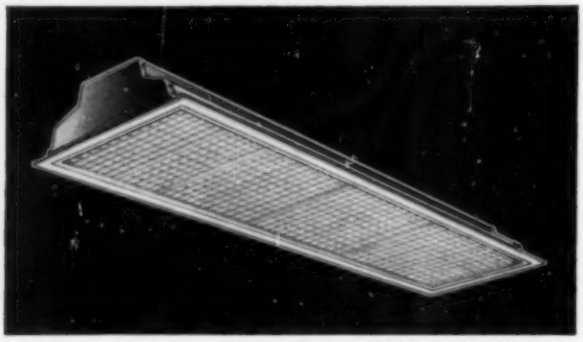
Two inches shallower . . . stronger yet one-third lighter, new Mobilex is faster, safer, easier to install. Takes less space. Increases design freedom. Produces better specifications.

Mount end to end or side by side. Mobilex is interchangeable with acoustical ceiling panels. You can add fixtures later, *inexpensively*. Improved reflector shape. Choice of glass, plastic or louvered enclosures. Patented Cleartex Mobilex shown above. Available as 2-foot, 4-foot or fill-in sections.

NEW LOW PRICE plus proved reputation for low installation and maintenance costs puts Mobilex in a class by itself. Call your local Day-Brite representative for a demonstration, today! He's listed in the Yellow Pages.

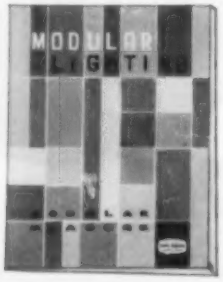
New Day-Brite Troffers! New Low Prices!

ALZAK PARALOUVER® . . . patented aluminum Paralouvers reduce brightness in "glare zone." Parabolic shape of Alzak body and center louver control brightness from side. Available in 4-foot, 8-foot and fill-in sections for all plaster and acoustical ceilings.



PLASTIC WAFFLETEX® . . . designed for high light transmission, low brightness. Light in weight. Hinges from either side for easier maintenance. 4-foot, 8-foot or fill-in sections for all plaster and acoustical ceilings.

FREE



New illustrated booklet on Day-Brite Mobilex and Troffers!

71186

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

CLIP AND MAIL TO:

Day-Brite Lighting, Inc.
5432 Bulwer Avenue
St. Louis 7, Missouri

Please send me_____copies of the new illustrated booklet on Day-Brite's Modular Method.

*NAME*_____

*ADDRESS*_____

*COMPANY*_____

*CITY*_____ *STATE*_____

A Church Relighted

Fourth Prize
Class II

Werner F. Rosacker

Eastern Pennsylvania Section

East Central Region

Mr. Rosacker, who designed this installation in cooperation with Howard Eiler, architect, and John L. Medlar, electrical engineer, is with the Central Brass Works, Reading, Pa.

RELIGHTING interiors of existing church buildings usually presents many varied problems in achieving good lighting results compatible with the architecture, decoration and atmosphere of the building. The Memorial Church of the Holy Cross, in Reading, Pa., provided a full quota.

The Nave of the church is of rather unconventional octagon shape, carried out in Romanesque style. Floor area is 4,535 square feet, measuring 74 feet in diameter across the flat sides. Pews are arranged in a semi-circular plan, facing the Sanctuary on one flat side of the Nave. The floor slopes downward to the Sanctuary, which is separated from the first pews by an aisle and rail. Behind the rail are located the Altar, in the center, the Pulpit on the right side, and the Lectern on the left. Beyond the Lectern is the organ console, and behind the Sanctuary the choir section, facing the congregation, in three rows in steps.

The high sloping ceiling has four sides rising in flat plane to the middle of a large ornate center

dome. The alternating four sides rise to peaks, ending again about at the middle of the center dome. This dome is 20 feet in diameter, 40 feet from the floor to its base and 79 feet from the floor to its extreme top. Eight ornamental roof trusses are exposed, as are the other trusses and purlins.

Walls and ceilings were dark and pews and woodwork stained a very dark color. The four beautiful glass windows are of deep colors, allowing a little daylight to penetrate.

With no loft space for wiring, fastening or recessing fixtures, it was decided to use four central chandeliers, which would not disturb the spacious feeling of the high ceiling and dome. These were to be augmented, where possible, with concealed high-lighting.

Th four chandeliers are five feet in diameter, chain suspended from the four roof beams in the flat sloped ceiling sections. They are mounted 22 feet from the center of the dome at a height of 28 feet from the floor.

Each fixture is wired for five circuits:

(1) One 500-watt adjustable floodlamp for high-lighting the central dome.

(2) Five 150-watt adjustable floodlamps for general ceiling and indirect lighting.

(3) Six 200-watt reflector lens units with ornamental louvers. These are mounted on adjustable brackets to control the outward spread of light.

(4) One 500-watt silver-bowl lamp in central indirect dome reflector, with ornamental diffusing louver.

(5) Twelve 60-watt inside frosted lamps for general illumination and for lighting the glass panels of the fixture.

All circuits are dimmer-controlled for utmost flexibility. Fixtures are finished in dull gold and louvers and domes in matte pale ivory. Side and bottom fillout panels are of amber glass.

Supplementing the chandeliers, concealed lighting units are used, where possible, painted to match the ceiling. One 750-watt downlight is placed in a 10-degree forward position for general illumination of the forward pew and Sanctuary. This unit is located to the rear of the bottom band of the center dome. Also at this location are two 200-watt spots for highlighting the pulpit and lectern.

The Altar is accented by two more 200-watt spots behind each of the two forward main trusses and for the choir area, twelve two-lamp units using 150-watt R40 spots with clip-on louvers are concealed behind the purlins in the peaked portion of the ceiling over the area. The Baptistry and entrance alcoves are highlighted by four recessed 200-watt reflector units.

To build up the lighting level at corners and extreme sides of the interior, four 750-watt downlights and ten 200-watt spotlights are mounted behind the rear main trusses.

On the pew areas, an average illumination of 21 footcandles is obtained with all units at full brightness and 13 footcandles from central chandeliers only. At the Altar a level of 80 footcandles is provided; at the lectern and pulpit 40, and the choir area 28 footcandles. (Exposure for photo on the previous page was 15 seconds. It is interesting to not that for the "before" picture below, exposure was three *minutes.*)

The entire interior was redecorated in light colors, adding greatly to the seeing comfort of the congregation, who feel their church has gained a new warmth and inspiration, in keeping with the architecture of the building.

BEFORE

- **Four central chandeliers, originally made for gas and later electrified, each containing fourteen 100-watt bare lamps.**
- **Two ornate candelabra in choir area, also converted from gas, each with 24 candelabra base flame type lamps. These were seldom used because of wiring difficulties.**
- **Music racks contained tubular lamps for reading.**
- **Illumination level: 5 footcandles in area under the chandeliers.**

milj

Fourth Prize Class I

Living room — table lamps on dimmers.

Control—The Key To Modern Residence Lighting

A COOPERATIVE builder and home owner, willing to spend more than average for electrical equipment, were combined with know-how in achieving a well-coordinated lighting system integrated to the tasks required in each area of this 1½-story three-bedroom Milwaukee residence. With one exception, this was done using only available equipment from the distributor's stock.

Indicative of the trend in residence lighting, flexibility and control are built-in through the use of dimmers and special circuiting, in almost all areas of this home. Thus, in the living room, all table lamps are on dimmers for change in atmosphere and adaptability to the various types of eye tasks performed. Accent lighting is by a recessed eyeball unit highlighting the fireplace.

Beyond the living room is the dining "L" where six recessed units with conical perforated surface trim supply the general illumination. These are controlled by the two dimmers (beside pass-through to kitchen) in groups of two. Special switching allows change from line voltage to dimmer voltage

Ed Schnoll, Milwaukee Section, Midwestern Region, *who designed this installation, is a Lighting Engineer with Standard Electric Supply Co., Milwaukee, Wis.*

Dinette — as yet unfurnished — has special switching for all units. Recessed luminaires are controlled by dimmers, shown in rear.

Upper hall, and a glimpse of a bedroom.

for all units, including the vertically adjustable pendent fixture on traverse track, which provides a decorative note. The dining area is the only exception to the rule of using only commercially available equipment. The recessed units have been fitted with small hexagonal aluminum louvers for reduction of glare.

In the family room, a floor lamp and hanging wicker fixture supply light for normal viewing tasks, and two 150-watt recessed units are used for high level requirements, such as studying or card games.

In the kitchen, a luminous ceiling plus supplementary lighting make this work area an attractive spot to lure any woman. The ceiling alone gives 150 footcandles on the counter tops and supplementary lighting over work areas increases it to 500 footcandles for food preparation. Two-circuit control of the ceiling system, with one circuit on a motor-driven dimmer, is another feature of the kitchen lighting.

The bathroom also (not shown) has a full luminous ceiling which provides 80 footcandles at sink level and even more at shaving level. Cool white deluxe lamps are dimmer controlled.

A cathedral pitched ceiling over the stairs lends itself to pendent units on a swivel. Perforations, louvers and gold lamps blend with the interior motif. The upper hall (see photo) uses matching units, mounted close to the ceiling.

Bedrooms are lighted by 150-watt recessed luminaires, dimmer controlled, with dished glass diffusers. In the master bedroom, recessed sun lamps controlled with a timer switch are installed over the bed. All other units are low-voltage wired and controlled from a switch in the headboard. The recessed units in the two other bedrooms are circuited for either full illumination or 10-watt night lights.

Exterior lighting includes four marker lights at the edges of the driveway, with two hooded PAR floods on the side for safety. The doorway has a dropped glass square recessed unit with a matching surface-mounted wall bracket. A small stoop light is mounted flush in the concrete. Decorative lighting units enhance the patio.

Carrying the idea of control to its happy extreme, the complete house is low voltage with a master switch in the headboard of the bed in the master bedroom, from which everything electrical may be controlled — television, radio, outdoor floods and even coffee in the morning.

Luminous ceiling in kitchen is on two circuits for flexibility in level. Supplementary lighting is added over work areas.

Illumination Statistics

	High	Medium	Low*
Illumination**	20 fc	11 fc	2 fc
Brightness† at edge of cove	47 fL	33 fL	5 fL
Brightness† at center of dome	20 fL	11 fL	2 fL

*Blue lights only.
**Footcandle readings taken at seat level with a paddle meter, at 50 per cent of lamp life.
†Brightness readings taken with both Luckiesh-Moss brightness meter and the new Freund brightness meter. Readings of the two meters agreed closely, but where differing the higher is reported here.

Calculating Coefficients For a Church Dome

National Entry Class II

WHITE MEMORIAL Church (Seventh Day Adventist) in Los Angeles is a beautiful building with a dome 109 feet in diameter with its apex 69 feet from the floor. Specifications for the lighting were for three levels, with a maximum maintained level of about 20 footcandles.

Harold Strahn

Southern California Section

South Pacific Coast Region

Mr. Strahn, who was lighting consultant for this installation, is with the Department of Water and Power, Los Angeles, Calif. Consulting electrical engineer on the job was Chauncy Mauk; building was designed by Earl T. Heitschmidt, A.I.A.

Coefficient of utilization tables are made up for rectangular rooms, and the large curved surface of domed ceiling called for compensations and adjustments — wall area 10 per cent less? ceiling area 30 per cent more? — on the coefficient of an equivalent area square room. Calculations of this nature supplied an estimated C.U. of .22.

From this point, the recommendation was for 360 300-watt R-40 lamps in adjustable sockets mounted in the cove on 12-inch centers. Every third lamp is royal blue, and is separately switched on remote-control contactors from a small enclosed booth at the rear of the auditorium, providing the desired flexibility in lighting level.

Illumination levels and brightness readings are shown in the table. Corrected coefficient of utilization is .21.

Walls are of acoustic tile and beige-colored plaster. Draperies are rose beige and carpeting is beige. Woodwork is in light oak and the seats are upholstered in turquoise-colored plastic. Downlights over the organ and piano use 750-watt lamps. Maintenance of the cove lighting system is from a catwalk.

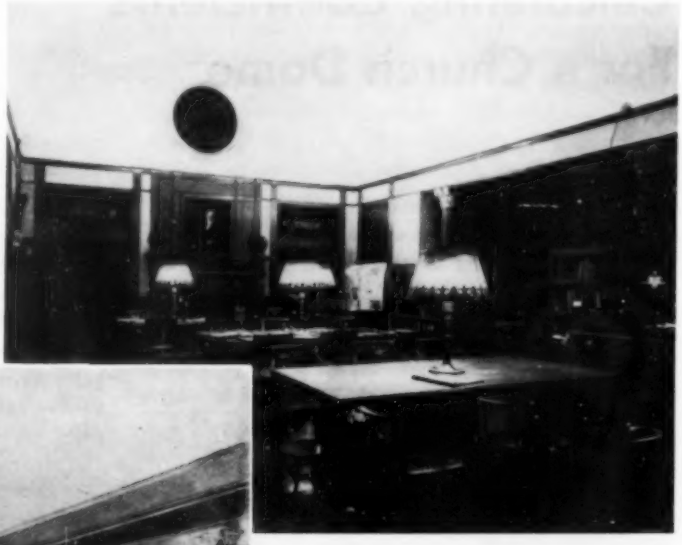
Contemporary Methods relight a nineteenth-century library

ONLY ONE change has been made in this library in over sixty years. Even the furniture used today is the same as that shown in the photograph taken from its dedication book. Date, 1896. The one change is, of course, in the lighting. In equipment, in application and especially in lighting results, it reflects the progress of illumination techniques over this period.

In the first picture, representing the room 60 years ago, the source of the illumination is shown to be two shielded kerosene table lamps, and two kerosene globe lamps on the mantel above the fireplace. No record exists of the illumination level. We do know that it was raised, about thirty years later, to some seven footcandles on the table tops with the installation of four electric table lamps.

Contemporary methods of lighting application are a far cry from the simple placement of a "reading" lamp. Applied to this dome-ceilinged structure they did, however, pose a few problems. As will be noted from the drawing, the ceilings in the main area and side transepts were dome-shaped, and of course, quite high. This same drawing also shows the solution conceived for this installation. In the 11-foot by 17-foot transept areas, two-lamp 40-watt fluorescent luminaires are arranged in a rectangular pattern and suspended 11 feet above the floor. In the main reading room a total of six four-foot-square shielded fluorescent luminaires, each using eight 40-watt lamps, are suspended 15 feet above the floor. These units are on 10-foot by 14-foot centers. General lighting in the main area

1926. Some thirty years ago, electric table lamps replaced the kerosene sources. Bases of the original lamps are mantel ornaments. Each table lamp housed a 750-watt PS-52 lamp in an indirect bowl at the top of the lamp, three 40-watt A-19 lamps around the collar. Wattage consumed, 3400; footcandle reading, 7. Compare with the "today" installation which also consumes 3400 watts, for a level of 60 footcandles.



1896. Lighting system sixty years ago, using kerosene lamps.

National Entry Class II

TODAY. Stratford, Connecticut, Public Library.

is supplemented by cove lighting down both sides of the room, designed particularly to enhance the architectural features of the room, and to reduce contrast between luminaire and ceiling. Installed 11 feet above the floor, the cove consists of a continuous row of single-lamp 40-watt strips. In the transepts, the two-lamp luminaires provide 25 per cent up-light to illuminate the dome. Lamps employed throughout the installation are four-foot rapid start fluorescent.

Hanging Problem

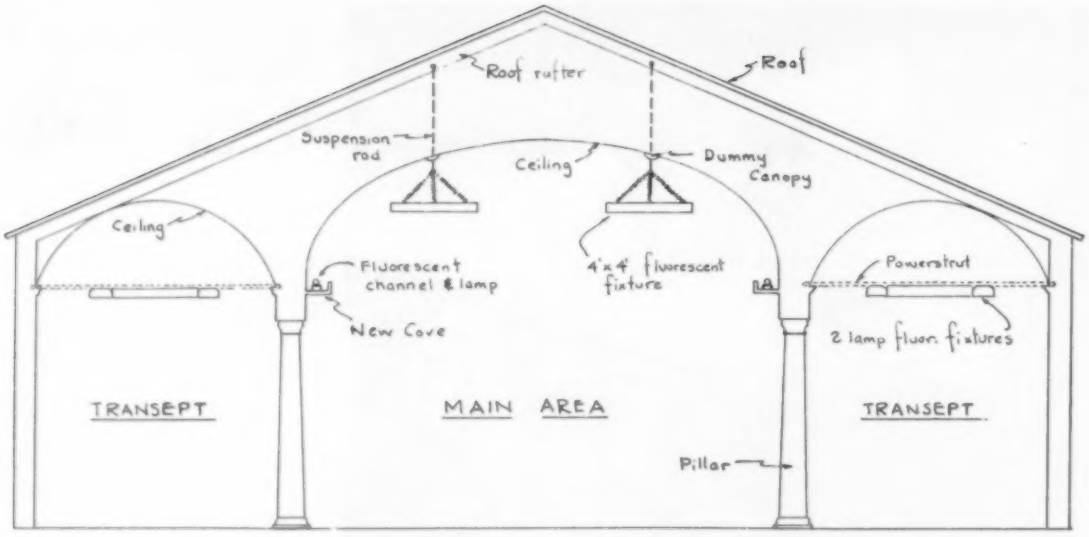
No small part of the problem encountered in this installation, was the difficulty of hanging the fixtures. The domed ceilings in the transepts are 15 feet high at midpoint and 11 feet high at the outer edges. The ceilings are of plaster on curved lath and will support no weight other than their own. The hanging problem thus presented was solved by suspending three runs of Powerstrut across the transept on six-foot centers. The Powerstrut was supported by and fastened to the molding at the 11-foot height, and painted white. It served as both the support and wireway for the 12-foot by 6-foot rectangle of standard commercial units using a Lucite diffuser.

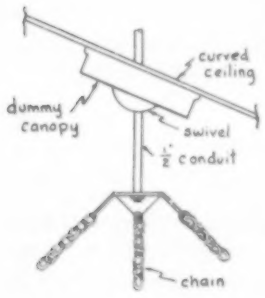
The curved ceiling in the main room was 18 feet high at midpoint, and 11 feet high at the outer walls. Here too, the ceiling construction of plaster on curved lath prevented the suspension of any weight from the ceiling. This problem was solved by bolting a four-inch round box to the two by ten roof rafter, feeding power by BX to the four-inch box and suspending half-inch conduit from the bottom side of the box. The conduit was extended through holes cut in the plaster ceiling, and a special four-pronged chain hanger plate was fastened to the bottom of the pipe. A dummy swivel canopy covered the ceiling opening. Heavy gauge bronze chain was run from each prong of the hanger plate to chain loops at the respective corners of the four by four fixtures.

Luminaires are actually "custom units," being constructed from two standard two by four-foot units mounted side by side in a special square metal frame. All exposed parts of the luminaires are finished in statuary bronze. Again, the diffuser is diamond Lucite, which was used to get the crystal effect of a glass diffuser without the weight of glass. The use of standard units and semi-standard units kept the cost of the installation at a level commen-

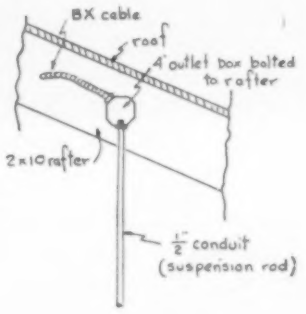
---

Russell W. Benjamin and Joseph Barney, Connecticut Section, Northeastern Region, *won Regional honors with this installation. They are with the United Illuminating Co. and the General Electric Supply Corp., respectively; both in Bridgeport, Conn.*





Technique for hanging luminaires (above). Domed ceilings are plaster on curved lath, by which no weight may be borne.



Rafter hanger (left). Chain and canopy (right).

surate with the usual budgets allowed for the maintenance of town buildings.

The coves were carpentered to match the existing woodwork, and tandem single lamp rapid start strips were mounted in the coves.

Footcandle levels in the building were increased by this installation as tabulated. (Readings taken 60 days after completion of the installation.)

	Illumination	
	Before	After
Table tops	7 fc	60 fc
Charging desk	3 fc	50 fc
Bookcase (Vertical footcandles)	2	29
Reference files (Vertical footcandles)	3	32

Reflection factors were raised by repainting the ceiling a flat white of 88 per cent reflectance, walls a flat mint green of 47 per cent.

It is interesting to note that these improvements were obtained with exactly the same wattage as the previous electric lighting system. The four large semi-indirect table lamps shown in the "before" picture, consumed approximately 3400 watts. The new lighting system in the main reading room, including the cove, also uses 3400 watts. In a way, the installation demonstrates lighting progress to date. With no appreciable change in architecture or furnishings, the lighting systems shown have progressed from the combustion illumination of the kerosene lamps, through the incandescent system, to the electric discharge sources. Bases of the original kerosene lamps, incidentally, may be seen in the picture as mantel decoration.

It might be said that this is only one method of lighting this area. It does show, however, one way of solving one of today's most prevalent problems: that of providing modern efficient lighting in older public buildings at a reasonable cost, without disturbing the charm and tradition of the building.

Stair Lighting
For Safety—Utility—Appearance

National Entry
Class II

Jack H. Murrah
Georgia Section
Southeastern Region

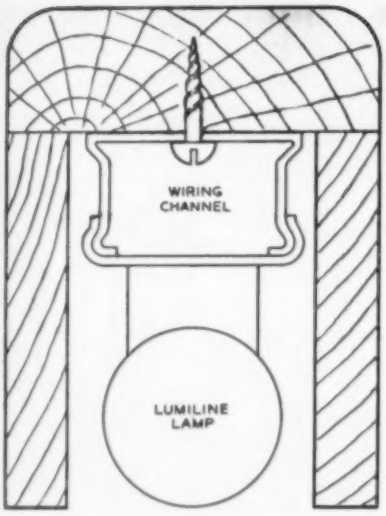
Mr. Murrah is with the Georgia Power Co., Atlanta, Ga. Photo of his installation, at the top of this page, is courtesy of Living for Young Homemakers.

Sometimes the lighting for a comparatively small area can be of as great importance and the problems as much in need of solution as for a large-scale installation. Such was the case in providing illumination for the entry steps of this Atlanta residence. Safety, utility and appearance made lighting necessary for the entrance, but the architecture of the glazed facade left no convenient or logical space for locating a fixture of conventional design, either ceiling or wall bracket mounted.

The solution arrived at was installation of the luminaires in the hand-rail of the steps. The wooden rail is of hollow construction, capable of holding 60-watt lumiline lamps and wiring channel.

The cross-section diagram of the hand-rail shows how the T-8, 60-watt inside frosted 18-inch lamps are installed on the channel. This is mounted by screws to the wooden hand-rail. The branch circuit cable is run through the iron pipe uprights and under the entry platform to a wall switch just inside the doorway.

The inside of the hand-rail is painted white for



Camera angle for photo at left is from three feet above the ground, in shrubbery beside stairway. Drawing shows cross-section of stair rail.

maximum reflectance. The bottom extremity of the lamps is even with the sides of the specially constructed rail, shielding any upward component and confining the light to the stairway.

In order to see the sources at all, the viewer must crouch behind the shrubbery with eye level no more than three feet above the ground — which was the camera placement for taking the close-up view of the underside of the rail.

Over 10 footcandles illumination is provided over the entire stairway, meeting safety requirements. The dramatic effect of highlighting the shrubbery increases the aesthetic appeal of the modern entry, and proper shielding takes care of glare. Lamps and fixtures are economical and available for easy maintenance. They are protected by the railing from rain and sun, and the incandescent sources are not affected by low temperatures.

Index to 1957—
Officer-Committee Directory

The annual Index to 1957, which will be published as Part II of the January 1958 issue, will give the business addresses, when available, of I.E.S. Officers and committee personnel for 1956-1957 and 1957-1958, and so can be used as a Directory for these active I.E.S. members.

Highway Visibility in Fog

By CHARLES MARSH

THIS PAPER is a progress report of investigations at the Pennsylvania State University and is published at this time to make results available as quickly as possible to others interested in the problem. It deals with the problem of fog on turnpikes, but much which has been learned has applications on public streets and highways, and for rail, air, and marine travel.

The project has been divided into four parts dealing with:

I. Vehicle Mounted Lamps
II. Fixed Lighting
III. Fog Detection and Traffic Control
IV. Equipment.

The Problem

When observing an object through fog, its visibility is reduced by fog droplets scattering the light emitted by or reflected from the object and the light from other sources, such as daylight, headlamps and street lights. Where none of the other sources is present, the brightness of the object is reduced by the scattering until it is not appreciably brighter than the surround and can no longer be identified. In the presence of the other sources of light, the object (whether black or self luminous) is masked by the scattered light (in the direction on the observer) between the object and the observer.

Our efforts have been towards increasing the visibility of light sources and markings when viewed through fog, and reducing the objectionable scattering of light from headlamps and street lights, roadside lighting and daylight.

I. Vehicle Mounted Lamps

Forward Lamps, Daytime

Although viewing vehicles head-on is not a common problem on turnpikes, it is desirable for vehicles to be visible from the front. In daytime fogs, most vehicle parking lights are less visible than the car itself. The lower beam of the newer type headlamp is inadequate. The upper beam, however, provides better forward visibility and therefore should be used.

Forward Lamps, Nighttime

At night in fog, headlamps or fog lights should illuminate obstructions and define the roadway as well as mark the vehicle. Illuminating objects in this way is not, of course, nearly as effective as if they had their own lights because due to the fog, less light from headlamps reaches the objects and some of that which fails to reach them is returned, by scattering, as veiling glare. So, since all objects cannot be depended upon to carry lighted lamps, headlamps must do the best job possible. If the road markings and all potential obstructions could be marked with fluorescent paint, ultraviolet light could be used for illumination, but the danger of a person's looking directly at powerful ultraviolet sources at close range is enough to make this method undesirable.

It has been found (1) that headlamps should illuminate the minimum volume of fog between the driver and the road, and (2) that the angle between the headlamp beam axis and the light scattered back along the driver's line of sight should be one to produce low values of scattering. In Table I, it can be noted that the most desirable angle is one in the region of 90 degrees, that is having the headlamp beam at a right angle to the viewer's line of sight. (Only the angles from 90 degrees to 180

TABLE I — Intensity of Scattered Light, Per Unit of Flux Incident, Per Foot of Beam Path Length.

Angle between incident light and scattered light in the direction of view	Unpolarized light	Polarized light viewed through crossed filters
20°	4400×10^{-4} ft^{-1}	19×10^{-4} ft^{-1}
30°	2900	13
40°	1500	9
50°	710	6.3
60°	400	4.2
70°	200	3.4
80°	100	2.7
90°	76	2.5
100°	57	2.6
110°	54	3.2
120°	63	4.3
130°	87	6.3
140°	160	10
150°	180	12.5
160°	180	16

From graphs drawn by the Polar Nephelometer of the Vision Research Laboratory, University of Michigan.

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 9-13, 1957, Atlanta, Ga. AUTHOR: Dept. of Electrical Engineering, Pennsylvania State University, University Park, Pa. Work done under Illuminating Engineering Research Institute Project No. 47A. Accepted by the Papers Committee of I.E.S. as a Transaction of the Illuminating Engineering Society.

Comparison of Test Results

Figure 1. This is a fogless view of the scene shown in Figs. 2 to 8. The road surface is four feet wide and 40 feet long, of rough textured hardboard sprayed with asphalt to simulate a black top road. The back of the truck is too large to this scale. It carries full size marker and turn indicators. The upper right and lower left markers are amber, the others red. The diagonal stripes are of beaded white paint scrubbed to give a traffic polished effect. The rectangular and cylindrical test objects in the foreground are painted dull black.

Figure 2. A luminaire of a type used in several toll roads is on in this picture. In this and the next two photographs the camera looks over a pair of low-mounted PAR-36 clear fog lamps. The common practice of showing lighted streets in the absence of headlamps seems unrealistic and increases the apparent value of silhouette seeing. The spotlight at the extreme right in this and several other pictures is part of the fog-regulating device.

Figure 3. These PAR-38 spots mounted overhead, much closer together than standard spacing, light the road. The angles between line of sight and direction of light are those having minimum scatter and so reduce the veiling glare seen in Fig. 2. In Figs. 2 through 8, the fog density is held constant at five per cent scattered per foot.

Figure 4. Here the road is lighted by low-mounted lamps to one side. The angles between light direction and sight lines are similar to those in Fig. 3 and so small amounts of light are scattered toward the driver. In addition, the volume of illuminated fog between driver and road is less since the lamps have sharp upper cutoff. For this scale, 40-watt PAR-46 fog lamps were used.

Figure 5. For vehicle-mounted lamps, a pair of PAR-36 clear fog lamps is mounted a few inches above the road surface. These were on in Figs. 2, 3 and 4, but here are shown alone. This should be compared with Fig. 6.

Figure 6. The lights used here, a pair of PAR-36 30-watt fog lamps, are the same as Fig. 5 except that they have been raised to where the angles between light beams and camera axis correspond to those between head lamps and driver's line of sight in modern passenger cars.

Figure 7. A 100-watt PAR-46 spot covered with a polarizing filter of about 40 per cent transmittance is used alone here. This is equivalent to an unfiltered 40-watt except that the filter reduced the 140-degree back scatter (rainbow) which is strongly polarized.

Figure 8. This differs from Fig. 7 in that a crossed polarizing filter was before the lens. The exposure was increased to be sure of recording all low brightness areas. The back scatter from the beam is reduced to about 0.01 of that in Fig. 7. The two squares at the lower right of the truck are retro reflective sheets. On each side of the license are plastic prismatic reflectors.

degrees are applicable to this situation since the headlamp beam is directed away from the viewer.) While 90 degrees can not be achieved, the larger angles of 140 degrees and near to 180 degrees should be avoided.

The arrangement which most nearly satisfies both of the above requirements has the headlamps placed as low as possible on the vehicle and projecting light in a thin layer close to and parallel to the road surface (Fig. 4). This results in low brightness of pavement but high brightness of objects on or beside it. A pair of clear or white 30-watt, PAR-36, fog lamps hung below the bumper is appreciably better than the newer type headlamps on lower beam; 40-watt, PAR-46 lamps are still better but on most cars, when mounted below the bumper, are too large for road clearance. Also, where legal, adding two small spots in the same area is helpful. One is aimed at the center line rather close to the car, the other along the curb side of the pavement.

The improvement achieved with the low mounted lamps is worth the trouble of the installation if only to reduce the volume of illuminated fog for any any vehicle. With low passenger cars, where the distance between the driver's eyes and the headlamp is small, little is gained with respect to reducing the angle between the headlamp beam and the light scattered back to the viewer; it will be no less than 175 degrees. In the case of a truck or bus with larger distances, an important gain is possible. A disadvantage of mounting lamps below the bumper, is the frequency with which these low lamps are knocked off by snow drifts and soft mud roads, and curbs where steep angle parking is practiced.

Another arrangement of lamps (the use of which must be restricted to responsible drivers, and then only on relatively level terrain) is to mount, and aim horizontally forward, a source (providing a narrow beam of high light intensity) quite low or as high as possible above the eye level on the center of the vehicle. The beam obscures only the center of the lane in the first position, nothing in the higher position. In the higher position the lamp provides a beam of nearly opaque illuminated fog above the road. This serves as a secondary source of light reaching ahead of the car. The effect is that of looking along a diffusely lighted tunnel or corridor. This is more effective in a moderate fog than in a light fog.

A polarized spot lamp and cross polarized viewer is the most effective fog light system developed so far, although polarized light penetrates fog to no greater extent than unpolarized light. Polarized light which is scattered back from fog is not depolarized but is blocked when seen through a viewing filter polarized at 90 degrees to the lamp filter, thus removing much of the veiling glare normally present. Light striking opaque objects lacking metallic lustre is partially depolarized and the object therefore, can be seen through the filter. Self luminous objects, such as tail and signal lights and traffic signals, as well as opaque objects, are not obscured by the filter. The following restrictions in the application must be observed for satisfactory performance of a polarized fog light system.

1. The plane of polarization of the filters used for polarizing and viewing must be either parallel or perpendicular to the plane defined by the lamp's center line or beam axis and the driver's eyes, the polarizor one way, the viewer the other way.

2. The beam spread must be such that if the light rays were projected back through the lamp, they would meet at a point on the lamp's axis defined by its intersection with a perpendicular line in the plane of the driver's eyes. If a broader beam is needed, it must be produced by more than one lamp arranged so that all meet this requirement.

3. This system will give visibility to opaque objects which depolarize the light, beaded painted pavement markings, plastic reflectors such as those used to delineate turnpikes and those on cars and trucks, and some forms of reflective sheeting, but not to the red tape commonly used on rear bumpers.

4. This system will obscure the scatter light produced by an oncoming vehicle similarly equipped. It will also obscure the headlamps and possibly a visual warning of the car's presence. If the polarizing filters are oriented at 45 degrees from the vertical, the polarized headlamp of the oncoming car will be visible and give warning, but the scattered light will also be visible, producing glare. So, since the scatter light is not desirable, at least one marker lamp would be needed for visual warning.

5. Since the polarizing filter transmits only about 40 per cent of the visible light, a 40-watt PAR-46 compares poorly in road illumination with a pair of sealed-beam headlamps of 40 watts each, on lower beam; therefore, more powerful lamps, such as 100-watt spots, will be needed.

6. With these high-power lamps, and where dense fogs require speeds of less than 20 mph, precautions are necessary to prevent overheating of the filters. The test installations have blower cooled filters.

To define a vehicle's position, two lamps are needed. Two lamps can also supply light at wider angles than one. Two 30-watt, PAR-36 lamps hung from below and behind the front bumper do this

adequately. Both spot and fog lights have been used, and each has advantages.

Rear Lamps

Rear lamps should receive as much care in design as headlamps. Whether in fog or clear weather, they may be the only indication of the size and location of the car, and of the intentions of the driver.

Tail, brake, or turn lights for use in clear atmosphere at night should differ in brightness from rear lights used in fog or by day. For clear nights, moderate brightness and large area provide adequate contrast and avoid distracting glare at close view, but with high enough intensity for distant visibility.

For use in daytime and in both day or night fog, a higher brightness lamp, which may be smaller, is needed to contrast with the high brightness of daytime fog, or, at night, with the fog illuminated by scattered light from vehicles and street lamps. At present, in day fog, the average tail lamp is useless except on very light colored cars.

The turn indicators on most passenger cars and the more recent truck signals are more visible than the present tail lights. On turnpikes, these could be operated on left turn without ambiguity as no left turns are permitted on most toll roads.

A preferred arrangement is that of providing a switch so that turn indicators can be operated in front or rear pairs as well as right and left. This would permit both rear signals to flash or burn steadily, increasing visibility and also removing confusion on roads allowing left turns. Turn signals only should be used as markers on trucks and on those cars which have separate lamps for turning and for braking. To do so where the same lamps are used for both functions would leave the driver with no braking signal.

An even better rear marker is a red lamp such as a 40-watt PAR-46 with its axis horizontal and either low (18 inches) or quite high. The beam should have a narrow vertical spread and a 30-degree to 40-degree horizontal divergence so that at a distance, in a light fog, the overtaking driver would see the full output, but as he approached would not be troubled by glare, because the main beam although visible would be either above or below his eye level. In denser fog, distant performance of this system is probably as good as any which can be achieved in practice and as the overtaking car approaches, scattering of light by fog droplets in effect widens the beam and maintains visibility.

A flashing rear signal has appeared to be less effective in fog than a steady lamp of similar color and power, although electronic flash lamps of high peak and power have not been tried.

One flashing setup that did show some promise but needs further study consists of two lamps of nearly equal luminosity but of complementary colors, such as blue-green and red, mounted close together and alternately flashed. No loss of orientation of the observer results, as one lamp is always on. The color contrast is high, even when the lamps are not themselves visible. This system could be used to stop traffic in fog, as in the case of accidents, or to define obstructions.

Higher mounting of rear lamps reduces the veiling effect of fog lighted by the headlamps or fog lights of the following car, and thus increases the nighttime visibility. The contrast of rear lamps in daytime can be increased by adding a dark surround. A lamp mounted outboard seems to stay cleaner than one flush mounted but suffers from higher background brightness.

No discussion in this paper should be taken to imply approval of red for tail or rear turn indicators. This is a separate problem which needs serious attention. Amber lights have been more visible than red, other factors being equal, both in scaled and road tests. Actually, on turnpikes, amber may be more restrictive than red. Small red lamps indicate a truck proceeding in the same direction as the observer, and the usual reaction is to turn out to pass it, whereas amber lamps suggest a truck crosswise in the lane and require immediate braking.

II. Fixed Highway Lighting

Work has progressed more slowly in this phase than on vehicle lighting because the latter installations are smaller and thus easier to modify, to examine in small volumes of natural fog, and to transport to naturally occurring fogs for full scale evaluation. This section is a progress report, made at this time to make our data available to others who are much more experienced in street lighting practice.

The following list of attributes of a lighting system suitable for satisfactory performance in fog is offered.

1. The volume of illuminated fog between the driver and the road should be small.
2. The light which must traverse this volume of fog should do it at angles with the driver's vision which produce the minimum light scattering.
3. Direct glare sources should be minimized for fog as well as clearer atmospheres.
4. Except for haze having particles much small-

er than fog droplets, color seems not to be a factor in scattering. But some colors, such as that from clear mercury vapor lamps, afford higher color contrast with red and amber signal lamps but seem to cause more peripheral haze.

Table I shows that the minimum scattering occurs between 75 degrees to 120 degrees. Therefore, the beam spread of a street light, measured from the vertical line through the lamp, should be limited between planes 15 degrees against traffic flow to 30 degrees with. This condition satisfies No. 2 and 3 of the above list. To include the condition of item I, light should strike the road at a near grazing angle, from lamps placed low and along the side of the highway and with beams at right angles to the direction of travel (Fig. 4). The obvious disadvantages of this last layout are obstruction by snowdrifts, disturbing shadows in the inner lane, and, unless well shielded, a flicker effect in passing these low-mounted lamps. However, the plan probably deserves some more thought and small scale trial before being rejected.

To completely satisfy condition No. 2, something similar to Fig. 3 is needed. Experiments in this direction are under way at reduced scale.

The only full-scale trial to date is the modification of ten conventional mercury vapor lights on the New Jersey Turnpike. External shields were installed to make them comply with No. 3 and to an extent with No. 2. The direct glare has been eliminated and the components at angles having the maximum scattering toward oncoming traffic have been redirected. The performance with these handmade shields is, of course, inferior to that of a light designed to do this, but appears to be better than before in both clear and foggy weather. We are still collecting reactions to this test.

III. Fog Detection and Traffic Control

This phase of the project has lagged but is gaining speed. Methods of indicating the presence of otherwise unexpected fog and of defining traffic lanes in dense fog have been studied.

At least one toll road has used red fusees to mark the edge of the road. These have been compared with other light sources. In light to moderate fog, a narrow beam, as from a 6-volt hand lantern in white, amber, or red, has been as effective as a fusee. A 30-watt PAR-36 spot with a slightly spreading amber or red lens is still better. In dense fog, the scattering is so thorough and frequent that the greater amount of total light from the fusee has given it the advantage over the hand lantern. But in a light fog or in a clear area on the windward side of a hill having fog at higher altitudes the smoke particles from fusees provide nuclei to stabilize or even initiate fog.

We have made a fair beginning in the task of constructing a device for detecting and measuring fog, which can be used with or without automatic control of traffic speed indicators. Mr. Lloyd Slocum of our department has constructed a device having high stability and sensitivity to changes in atmospheric transmittance.

In its present form it changes traffic speed signals for atmospheric conditions ranging from clear weather to two more restrictive preset indications as fog increases and atmospheric transmittance decreases. We have yet to package the amplifier portion for outdoor mounting. If this proves to be unsuited for constant duty field use, it will be useful in making measurements and for calibrating scattering type devices.

IV. Equipment

In order to compare the performance of proposed and conventional lights in fog, a reliable source of fog at controlled densities is useful. Naturally occurring fogs tend to be found in areas remote from the investigator and at inconvenient times. After several unsuccessful efforts, we have constructed a fog making device.

A commercially available air blast jet is operated with low volumes of water and large volumes of compressed air. A ten-horsepower compressor atomizes about three quarts of water per minute to produce small droplets (five-micron diameter range). Increasing the water flow produces larger droplets and a wetter fog. Studies by the Vision Research Laboratory of the University of Michigan indicate that this manufactured fog has optical properties quite similar to naturally occurring fogs. With very calm air it is possible to flood low areas with fog, but such conditions exist for only about two hours a day, some days, near sunrise.

To confine the fog in any weather we have erected a tent, 50 by 16 feet, with a maximum height of 12 feet. A floor of crushed stone reduces mud and shock hazard and a partition with windows across one end protects equipment and observers from dampness.

A road surface is represented to reduced scale by a four-foot-wide strip of hardboard, rough surface up. This is 40 feet long and has been sprayed with asphalt paint until its surface is a fair substitute for asphaltic concrete. From a framework of lumber, overhead lamps can be installed. The road is to the left of the tent center so that low mounted lamps may be placed up to 10 feet from the edge

of the road. Just in front of the viewing window is a frame carrying front mounted vehicle lights. A scale model of a truck rear surface carrying various rear lamps is mounted on a low car which can be moved along the road from the control board.

This work has been in part supported by the Illuminating Engineering Research Institute as Project 47-A. Fog measurements and much other help have been obtained from the Vision Research Laboratory of the University of Michigan.

The author gratefully acknowledges the helpful suggestions of many individuals and the cooperation of several manufacturers.

DISCUSSION

CHARLES REX:* Obviously splendid work has been done on this most difficult and highly complex problem. Professor Marsh and his associates at the Pennsylvania State University, along with Dr. H. R. Blackwell and his associates at the University of Michigan, have shown what is being accomplished on an important project sponsored by the Illuminating Engineering Research Institute and guided by the I.E.R.I. Technical Advisory Committee on Light and Vision.

This project was initiated through the I.E.S. Committee on Street and Highway Lighting and, in particular, Ellis Paul, Consultant for the New Jersey Turnpike Authority. The subcommittee appointed several years ago quickly came to the realization that the data and opinion on the subject of visibility in fog and smog were voluminous and difficult to interpret. We were glad to have the I.E.R.I. investigate the problem and set up the two projects at Michigan and Pennsylvania State that could be done. Ellis Paul, with the cooperation of his subcommittee, Professor Strong, and C. L. Crouch, obtained the money necessary to get started. Both Universities have contributed generously. Professor Marsh has even had significant aid from his family. The result of such cooperation has been presented to you in the form of a report on real progress. There is a lesson to be learned. I agree most heartily with Kirk Reid's reference to I.E.R.I. as a "crusade" for progress in research.

Future work will doubtless give us the answer as to the extent by which conventional roadway lighting (instead of no lighting at all) improves visibility during fog or smog conditions. This was our No. 1 question in 1953.

We also should know how much light is necessary for visibility with conventional roadway lighting and the special purpose, closely spaced reflector downlighting. How is visibility to be measured under both fog and smog conditions?

As C. L. Crouch sums it up, "The next step is to quantify the relationships between lighting and visibility distance."

Most assuredly this work should be continued.

Incidentally, may I point out that the 15-degree cut-off that Professor Marsh is recommending will extend about 0.5 MH, or 15 feet longitudinal distance from the luminaire. This is narrow beam downward floodlighting, quite different from current roadway lighting practice. Such a cutoff is much lower than that necessary to minimize discomfort glare or disability veiling glare because the top of auto windshield shields the driver's eyes from luminaires at distances greater than 3.0 to 3.5 MH.

During last October the New Jersey Turnpike was shut down on three nights because of fog. Professor Marsh has been called in to help decide on how trial lighting will be installed to help avoid further financial losses and inconvenience to motorists. Perhaps he will tell us what is being accomplished by the full-scale tryout on New Jersey Turnpike.

D. A. TOENJES:* In this progress report, Professor Marsh describes an investigation that is in the nature of a laboratory study under simulated field conditions. We expect that this continuing project will add significantly to available knowledge on the practical effects of light-scattering characteristics of fogs — and possible methods to best provide driver visibility on roadways under fog conditions.

Under the topic of "forward lamps at night," the author states that the polarized lighting system will give improved visibility to opaque objects that depolarize the light, such as painted pavement markings, plastic reflectors, and some forms of reflective sheeting; but not the red tape, used on rear bumpers. What about the reflectorized traffic signs, such as the red stop signs? Will that reflective surface be made more visible, or does it not depolarize the light?

There is also presented the possibility of low-mounted light sources, to project forward light in a thin layer close to the road surface. It appears that, here, the precise light control is required only in the vertical plane — and this suggests the possibility of using "linear" rather than "point" sources of light, in order to achieve high efficiency or rugged lamp construction. These light sources might be in the forms of linear, horizontally-mounted mercury-vapor lamps, or the new tubular quartz-enclosed filament lamps. Possible advantages for either type of light source might be compactness of a high-intensity source, and ruggedness; in addition, mercury lamps would have high efficiency also.

Under the general topic of vehicle-mounted lamps, perhaps there should be some statement as to requirements of State laws regarding color of light on the front, side and rear of vehicles. Are all such State laws in agreement with this? If not, could Professor Marsh summarize the variations?

Under the general topic of "fixed highway lighting," the subject of polarized lighting is not mentioned in the paper. However, we did inspect the author's test equipment, where there were some appraisals of roadway lighting with polarized shields on the overhead luminaires, with the roadway viewed through a cross-polarized "analyzer." As we recall, the polarization of light from the overhead luminaires was accomplished by suspended vertical polarized shields outside the luminaires. There are now on the market some street lighting luminaires using refracting glassware, but open at the bottom, so the glassware itself is an open cylindrical section, round in cross-section. It would appear that for possible future tests, the polarized sheeting could be laminated directly to this glassware, if luminaires of such design were used in some of the appraisals.

Would it not be important to the reader of this paper to have a list of the previously-published literature on this matter of lighting under fog conditions, and on light-scattering characteristics of fog also? Perhaps Professor Marsh would add such a list of references here; to point out some of the basic studies which are capably supplemented by this

*Outdoor Lighting Dept., General Electric Co., Hendersonville, N. C.

*Application Engineering Dept., Lamp Division, General Electric Co., Cleveland, Ohio.

present work. One list of such references is given in the University of Michigan's Report No. 2557-2-F, "Preliminary Studies of Visibility on the Highway in Fog" by B. S. Pritchard and H. R. Blackwell, July 1957. Professor Marsh might supplement that list with other references that he has used.

CHARLES MARSH:* I appreciate these discussions and will attempt to answer the questions raised.

We still do not know the answers to Mr. Rex's first two questions about the in-fog effectiveness of conventional roadway lighting and how much we need of it or of any type.

There is currently some confusion on visibility measurements. The use of devices which measure transmittance of a fixed path through the atmosphere is common, but we may need more thought on converting these values into an indication of visual distance.

Some of the conclusions in this paper are finding rapid application in an experimental installation by the New Jersey Turnpike. A one-half-mile section near Elizabeth is being lighted in both directions by fixtures which confine the light to angles having relatively low scattered components toward the approaching drivers. The light will probably be confined to one or two lanes each way with traffic being funnelled into them at the ends of the test strip.

Part of the section will be similar to the closely spaced narrow beam projector lamps shown in the photographs of the sealed roadway.

The remainder will apply the idea very similar to that suggested by Mr. Toenjes of linear light sources in low mounted units. We hope that the installation may be completed by the end of 1957.

Some of the reflectorizing material fails to depolarize light and therefore appears dark through a crossed filter. For this and other reasons the polarized vehicle lights should not be used except with some other low mounted unpolarized lamps.

The various states have widely differing laws concerning vehicles' lamps, so I dare speak only about my own state of Pennsylvania where everything this paper advocates is thoroughly illegal.

Polarized fixed roadway lighting shows interesting possibilities and merits further study.

No bibliography had been included in the paper because there are already so many. However, since one is requested, a few references are added below:

1. *Literature Search and Evaluation of the Physics of Fog*: Stanford Research Institute Report No. 1, February 16, 1953.
2. Leipper, Dale F.: *Fog Bibliography*, Scripps Institution of Oceanography Contract N 6041-211 Fog Project Report No. 1, 1947, 14 pages.
3. *Meteorological Abstracts and Bibliography*, Vol. 6, 1955, American Meteorological Society, Boston.
4. Middleton, W. E. K.: *Vision Through the Atmosphere*, University of Toronto Press, 1952.

*Author.

Application of Non-Circular Cross Section Fluorescent Lamps

(Discussion of paper by G. R. Baumgartner, R. T. Dorsey, and E. A. Linsday, published November ILLUMINATING ENGINEERING)

R. D. BRADLEY:* Many of us who have occasion to photometer lighting equipment have used 9.25 lumen-candlepower ratio for symmetric sources, using this figure to standardize our equipment from the bare lamp source. A similar figure for this new asymmetric source would be worthwhile, and the paper points the way to obtaining this value.

It will be noted from the typical distribution curve that the T section is quite uniform about its 90-degree axis, and that any error in set-up, even though it amounted to several degrees, would not appreciably change the candlepower value. From the information contained in Table II it will be found that the lumen-candlepower ratio based on indexing at the 90-degree point for Plane T is 8.4.

The published data indicate air movement in the range of three miles per hour, also indicating that this is a barely appreciable air movement. I would appreciate the authors' comments as to whether or not this would be the approximate value of the air movement around the lamps in a ventilated industrial fixture in still air at 77-degree ambient.

In Fig. 8 it is proposed that the curved louver section is a novel invention. This idea has been used many times and is in commercial use by ourselves in the form of the "Para-louver."

Fig. 13 shows a louvered section described as being of "interesting texture." It is my belief that this might better be described as "streaked." I have tried the use of the metal strip contacting the lamp bridge to increase light output, but could find no appreciable difference. My tests were conducted over a relatively short period of time. It might be that a longer time is necessary for this increase to occur.

Ballast temperatures may prove to be quite restrictive unless great caution is used in the design and application of these fixtures. It is felt that the ballast design should be reviewed with the view in mind of reducing their operating temperature.

The authors have recognized that reflected glare may become a serious problem. I concur in this thinking. Even in industrial areas I feel that some form of prismatic or diffusing control should be utilized, as the spectral reflection of 9400 footlamberts can produce an extreme amount of discomfort.

W. P. LOWELL, JR.:* Comment has been made elsewhere on the difficulty of measuring high loaded lamps of *uniform* cross-section. At least these lamps are symmetric, so simple spherical photometry can be used as compared to the extensive candlepower distribution method which is required by lamps on non-circular cross-section.

The authors point out the necessity of proper design of

*Day-Brite Lighting Inc., St. Louis, Mo.

*Sylvania Electric Products Inc., Salem, Mass.

equipment, and of having the lamps properly positioned in the equipment, either "groove-down" or "groove-up" etc. Have the authors considered any method of simple orientation, so that the consumers will put replacement lamps right side up?

It is obvious that the brightest area is in the bottom of the grooves, and more light output comes from that direction. It has been our experience that the fastest depreciation of light output is in these same areas. Now if the lamps are installed in a "groove-down" position, is it possible that they will start out as a semi-direct light source, but shift during life so that they become in effect a semi-*indirect* source?

R. T. DORSEY:* The authors appreciate the interesting points made by the discussers. First as to Mr. Bradley's discussion.

(1) Since the candlepower distribution varies substantially in a plane perpendicular to the lamp axis, the authors consider the four-point checkup method desirable to give adequate accuracy. Furthermore the method described is particularly helpful in fixture photometry.

(2) Air movement through most fixtures may be below perceptibility although it is in the one to two mile per hour range according to limited tests and therefore adequate for good lamp performance.

(3) The curved wedged louver has not appeared previously in the literature to the best of the authors' knowledge. "The Paralouver" is also designed to achieve brightness control.

(4) For the metal strip technique to be effective, all the condensed mercury in the lamp must migrate to this cool area. This may require as much as 100 hours operation.

(5) Ballast temperature reductions generally require larger, heavier, and more expensive ballasts.

(6) In environments such as schools where reflected glare is a serious problem, consideration should be given to lower brightness fluorescent sources or diffusing media.

With reference to Mr. Lowell's comments:

(1) Spherical photometry is of course used for all types of fluorescent lamps and is the most accurate method of determining total lumens. Unfortunately few laboratories have the large (generally 120-inch) spheres needed for eight-foot lamps.

(2) The lamp base permits inserting the lamp in only two directions. Where the groove is sideways it makes little difference which way it is put in. Whether the groove is up or down makes little difference initially; and it was considered that most maintenance people would recognize the obvious advantage of putting the groove down because less dirt could accumulate on the lamp.

(3) Present tests indicate that the depreciation in light output from the groove may be slightly greater than the rest of the bulb, but that no major difference will be noticed. It is expected that improvements will make this difference negligible.

*Co-author: General Electric Co., Cleveland, Ohio.

Fluorescent Strip Runway Lighting

(Discussion of paper by S. C. Peek, published October issue of ILLUMINATING ENGINEERING)

T. H. PROJECTOR:* Floodlighting of the touchdown area of a landing strip, as described in this paper, appears to be a promising method for eliminating "black hole" during landings and thereby making landings smoother and safer. I was among those who attended a demonstration of the Andrews Field installation, and it seemed to me from my position of observation in the cabin that the floodlit touchdown area should have been helpful to the pilot. Inevitably in such an installation the luminance of the runway areas near the luminaires is much higher than that near the center of the runway — the part which is of greatest interest. This effect may be seen in Fig. 8. While it is not practicable to eliminate the sharp gradient of luminance, it may be possible to reduce the gradient somewhat. I understand that improved models of essentially the same design as the one shown in Fig. 4 will effect such a reduction. I would like to ask Mr. Peek if he has considered the possibility of obtaining still further reduction of the luminance gradient by construction of the fixture with the lamp at the bottom or by construction of the reflector in segments?

As Mr. Peek points out, the texture of the runway surface is very closely related to the effectiveness of the floodlighting. To the extent that portions of the surface of the runway are inclined toward the luminaires they receive more flux and are likely to be higher in luminance to the pilot. Although in general, runway surfaces are required to be very smooth, especially for the new high landing-speed aircraft, this requirement is severe principally in the direction of landing. It may be possible to introduce controlled irregularities in the runway surface — for example by scoring the surface parallel to the runway axis — which will materially improve surface and marking luminance and contrast without interfering with landing safety or smoothness.

S. C. PEEK:* I appreciate Mr. Projector's desire to reduce the ratio of luminance between the center and edge of runways. I would like to point out, however, that the high illumination along the edges may be desirable since it defines the edge of the runway in a decisive manner. The idea of turning the reflector over has been considered and such a change would result in less contrast between the edge of the runway and the center. However, it would result with all the designs known to date in additional light up into the sky which is particularly bad in the case of fog conditions. We believe that non-uniformity of runway luminance is no way near the problem that light shining up into the sky, or into the pilot's eyes would be. The idea of scoring the runway surface parallel to the runway axis is an interesting one and we plan to test this together with herringbone type of markings.

*National Bureau of Standards, Washington, D. C.

*Author: Sylvania Electric Products Inc., Salem, Mass.

Effective Intensity of Flashing Lights

By THEODORE H. PROJECTOR

Flashing lights are in widespread use as signals, markers and warnings because of their distinctiveness and their superiority over steady burning lights in attracting attention. Complete evaluation of flashing lights or lighting systems employing flashing lights usually requires the weighing of many factors such as configuration, background, information to be presented, etc., and may involve complex, elusive, psychological elements. In most applications of flashing lights to land, sea, air navigation or traffic control, one of the fundamental considerations is the apparent or "effective" intensity of the lights. This has been the subject of considerable research for over a century, especially since 1911, when the classical work of Blondel and Rey was published. It is the purpose of this paper to review existing psychophysical knowledge in the field essential to the design and evaluation of flashing lights.

The evaluation of the effective intensity of a flashing light is relatively easy under some conditions and very difficult under others. If the flashing light is viewed under conditions such that the illuminance at the observer's eye is at or very near his visual threshold ,then the problem is relatively simple. For threshold viewing, Blondel and Rey defined the effective intensity of a flashing light as the intensity of a steady light which is seen at threshold under the same conditions. The experimental techniques for ascertaining the threshold for a steady light may be used to determine the equivalent threshold for a flashing light. If, however, the flashing light is viewed under conditions in which the illuminance at the eye is above threshold, and especially if it is far above threshold, it is difficult if not impossible to exclude from any judgment as to effective intensity psychological elements which are not present at low levels. Observers find it difficult to distinguish between the judgments "equally intense" and "equally irritating." In spite of this difficulty, the concept of effective intensity has been extended to above-threshold viewing, and has been found useful at least at relatively low levels, that is, up to about twenty times threshold. The experimental technique for above-threshold measurements of effective intensity involves the comparison of a flashing and a steady-burning light, one of which is varied in intensity until the observer reports apparently equal intensity. Such judgments are difficult to make, requiring as they do the equating of profoundly dissimilar appearances. The results of above-threshold measurements indicate that the effective intensity of a flashing light varies with the level of illuminance at the eye, and is thus fundamentally different from the intensity of a steady-burning source, which is a fixed property of a light source, essentially independent of the viewing condition. The concept of "effective intensity" may be useful only at the lower levels of illuminance at the eye where the fundamental ability to see is of great importance, so that the difficulty of making intensity judgments at higher levels may not have practical implications. In any event any measure of effective intensity of flashing lights must be related to the viewing conditions, and the use of the concept should be avoided at high levels of illuminance.

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 9-13, 1957, Atlanta, Ga. AUTHOR: Photometry and Colorimetry Section, National Bureau of Standards, Washington, D. C. This paper was prepared as a part of the work in the development of aircraft lighting conducted at the National Bureau of Standards under sponsorship of the Bureau of Aeronautics. Accepted by the Papers Committee of I.E.S. as a Transaction of the Illuminating Engineering Society.

Classical Work of Blondel and Rey

The experimental work reported by Blondel and Rey in 1911[1] consisted of a series of determinations of threshold illuminance with the observers viewing a centrally fixated point source of incandescent-lamp light which was flashed with a shutter at controlled durations from 0.001 to 3 seconds. The wave form of the flash was approximately square; that is, the light appeared at full intensity at the onset of the flash, remained at full intensity for the duration of the flash and then fell abruptly to zero at the end of the flash. For each flash duration, the intensity of the light was varied to establish the threshold. The results of the experiments are shown in Fig. 1.

The ordinate of a point is the ratio of the energy of a threshold test flash to the energy of a three-second threshold flash, expressed as $Et/3E_3$, where E is the instantaneous illuminance at the eye during the test flash and E_3 is the instantaneous illuminance at the eye during the three-second flash. A three-second flash was chosen for comparison

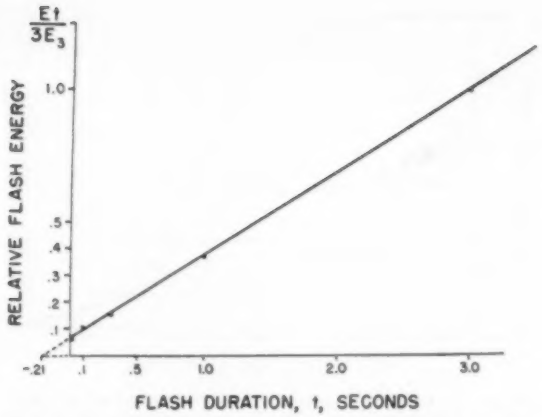


Figure 1. Ratio of test flash energy required for threshold excitation to energy of a threshold flash of 3 seconds duration as a function of test flash duration. (Blondel and Rey).

with the test flash as representing a duration sufficiently long that the effective intensity would be closely equal to the intensity of the same lamp burning steadily. The abscissas are the durations of the flashes. Blondel and Rey found that a straight line could be fitted very well to the experimental points plotted on the graph, and that the equation of this line could be expressed in the form:

$$\frac{E_o}{E} = \frac{t}{.21 + t}$$

where E_o is the threshold illuminance for a steady source and E is the illuminance during the time t of a flashing light at threshold. If it is kept in mind that the equation applies to threshold illuminance under a given set of viewing conditions, then intensity may be used interchangeably with illuminance:

$$\frac{E_o}{E} = \frac{I_o}{I} = \frac{t}{.21 + t}$$

and one may refer to the effective intensity as a property of the flashing light.

The Blondel-Rey equation has been investigated extensively since 1911 by Blondel and Rey themselves,[2] and by many others.[3,4,5] (The references cited above and in what follows are not intended to be complete but are selected as illustrative, or as of special importance. Work done prior to 1911 was summarized by Blondel and Rey,[1] and many additional references will be found in the other references given in this paper.) The validity of the equation has been generally well established, not only under the special conditions studied by Blondel and Rey, but also with sources of different sizes,[6] with observers in different states of dark adaptation,[7] with observations made in peripheral areas of the retina,[8,9,10] and with different colors.[8] Research work on the relation between effective intensity and the wave form of the flash, extremely short durations, the level of illuminance at the observer's eye, and flash repetition rate will be discussed in detail later. In addition to the investigations which have been more or less directly connected with effective intensity, there have been a number of studies of more complex visual problems connected with flashing light signals in which effective intensity played an important part.[11,12] Such studies have yielded results consonant with the Blondel-Rey equation.

Analysis of the Blondel-Rey Equation

The Blondel-Rey equation has been found to have such widespread applicability that it might be well to analyze its implications before discussing its specialized aspects. Its simplest general expression (for flashes of square wave form) is

$$\frac{I_e}{I} = \frac{t}{a + t} \qquad (1)$$

where I_e is the effective intensity, I is the instantaneous intensity during the flash, t is the duration of the flash in seconds, and a is a constant. The value of a found by Blondel and Rey, 0.21, has been confirmed by subsequent work, although the inherent imprecision of experimental work in this field makes it desirable to round the constant to 0.2. As will be shown later, the constant a appears to decrease as the level of illuminance at the eye increases, with the value of 0.2 representing its maximum value at threshold illuminance.

For purposes of analysis, methods of flashing lights may be divided into two categories. In the first, the light is burned steadily, and flashing is obtained by occulting the light with a shutter or similar device so as to conceal the light from the observer except during the flash interval. In this method, the light from the source is not visible during the dark intervals and the luminous energy emitted during the dark interval, as well as the corresponding electrical or other form of energy which produces it, may be considered "wasted." In the second category, the light source is energized only during the "on" interval, as when flashes are produced with an electrical switch, or by discharging the electrical energy stored in a condenser into an electronic flash lamp. Flashes produced by these methods do not involve "wasted" energy although the efficiency of utilization of energy may vary with the type of light source and the method of producing the flash. Flashes produced by oscillat-

ing or rotating steady burning light are considered to belong in this second category, since the light energy is fully utilized when, as is usually the case, all the directions swept by the beam are of importance.

Fig. 2 gives curves of the Blondel-Rey equation for flashing lights of the first category, where a steady burning light of intensity I is exposed for a time t, yielding an effective intensity I_e. The effective intensity for extremely short flash durations approaches zero, increases rapidly as duration increases, and finally approaches the steady intensity I asymptotically as durations become relatively long. According to the mathematics of the equation, it would take an infinitely long duration to achieve full equality of I_e and I, but for practical purposes the two are equal when the duration is of the order of two or more seconds, depending somewhat on illuminance level. The relation between illuminance level, as represented by a corresponding value of a, and effective intensity, is shown in the figure. For example, for a duration of 0.2 seconds, I_e is about 50 per cent of I at threshold when $a = 0.2$, but about 90 per cent of I when the illuminance is such that $a = 0.02$. Thus, if a given flash of light appears equal in intensity to a given steady burning light when both appear to be at threshold, then the flashing light will appear more intense than the steady light when the conditions of observation are such that they both appear to be well above threshold. This effect may explain a number of apparently anomalous field observations

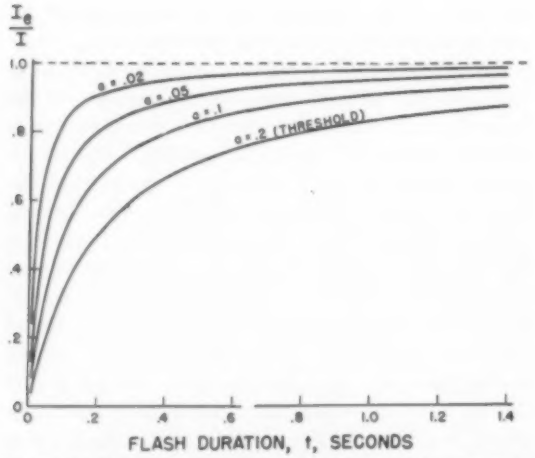


Figure 2. Effective intensity ratio, I_e/I, as a function of flash duration, according to the Blondel-Rey equation (equation 1), for the case where a steady burning light of intensity I is exposed for a time, t. Curves are shown for threshold illuminance when $a = 0.2$, and for above-threshold illuminances when a has the values 0.1, 0.05, and 0.02.

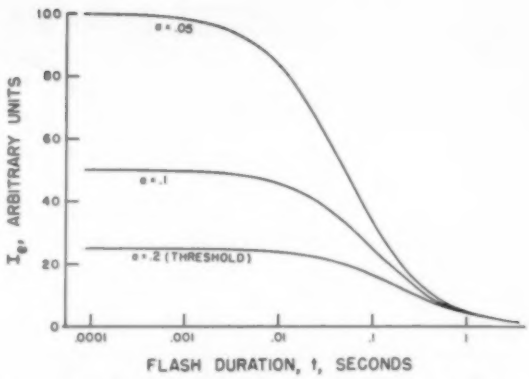


Figure 3. Effective intensity, I_e, as a function of flash duration, t, for flashes of equal energy, at $a = 0.2$ (threshold illuminance), 0.1, and 0.05, plotted from equation 3, with k arbitrarily chosen as equal to 5.

wherein comparisons between flashing and steady lights or between flashing lights of very different flash durations do not give the same results when the comparisons are made close to the lights and illuminances are high as they do at considerable distances where the illuminances are very low.

For flashing lights of the second category, where there is no "waste" energy, a more meaningful presentation of the Blondel-Rey equation is shown in Fig. 3. In these curves the effective intensity for flashes of equal luminous energy is plotted against flash duration.

To obtain the curves of Fig. 3, the numerator of the right side of the Blondel-Rey equation, written in the form:

$$I_e = \frac{It}{a+t} \qquad (2)$$

is kept constant by varying I and t inversely with respect to each other so that

$$I_e = \frac{k}{a+t}, \qquad (3)$$

and plotting I_e against t. I_e becomes zero if t is increased sufficiently. As t is decreased, I_e increases, and finally, when t becomes very small compared to a, I_e levels off to a value given by:

$$I_e = \frac{It}{a}.$$

At threshold, when $a = 0.2$,

$$I_e = 5\,(It).$$

As in the case of shutter flashing in the first category, the relative effectiveness of an above-threshold flash is greater than it is at threshold. For example when $a = 0.05$,

$$I_e = 20\,(It).$$

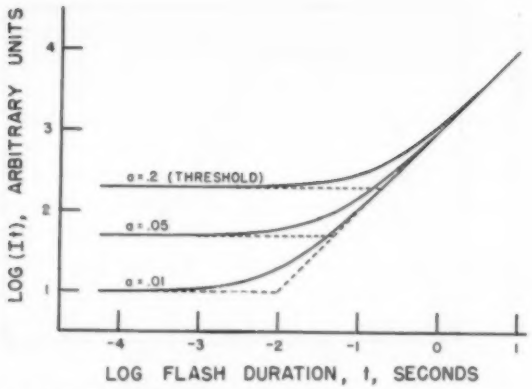


Figure 4. Flash energy (plotted as It) required to produce a given effective intensity, as a function of flash duration, at $a = 0.2$ (threshold illuminance), 0.05 and 0.01.

It will be noted that as a is decreased, the duration time t at which the curves level off is decreased, but in every case, leveling off occurs, and further reduction of the time of the flash produces no further increase in I_e for flashes of constant energy. Thus for extremely short flashes, such as those obtained with electronic flash tubes ("strobe" lights), I is reciprocally related to t for a given I_e according to the Blondel-Rey equation in a manner analogous to the equations used for determining photographic exposure.

The curves of Fig. 3 show the relationship between luminous energy in the flash and flash duration. A variation of this form of presentation, used by many research workers,[10,11] is shown in Fig. 4. In this figure, the luminous energy (plotted as It) necessary to produce a given effective intensity is plotted against flash duration. When the Blondel-Rey equation is plotted in this way, two distinct parts of the curves are clearly indicated. The portion at the left, for very short flash durations, shows the reciprocal relation between I and t, as does Fig. 3, where

$$It = \text{constant}.$$

The part at the right indicates that for long durations

$$I = \text{constant}.$$

Between these two regions the curve blends smoothly from one limiting relation to the other. The two limiting relations are plotted as straight lines and their intersections, shown in the figure by dashed lines, define the "critical duration" or the duration marking the boundary time between the two relations. It may be noted that the critical duration at threshold is about 0.1 second. Fig. 4 may be compared with Fig. 1, from Blondel and Rey, which is similarly plotted except that the scales of Fig. 1 are linear rather than logarithmic. The logarithmic form of Fig. 4 shows clearly the two parts of the curve.

For a clear understanding of the significance of the curves of Fig. 4, and particularly to clarify the relationship of the curves for different values of a, it may be helpful to describe an experimental procedure for obtaining them. With observers stationed at some arbitrary distance from the light source, the intensity of the flash at very long duration is adjusted until the flashes appear to be at threshold. The curve for $a = 0.2$ is then obtained by reducing the flash duration by set amounts and determining the relative energy required to maintain the light at threshold. When that is done the light is readjusted to the intensity and duration prevailing at the beginning of the experiment and the observers are stationed at a point closer to the light by an amount sufficient to raise the illuminance to a level above threshold corresponding in this case to $a = 0.05$. A curve for $a = 0.05$ is then obtained as before (except that a comparison technique must be used instead of threshold observations) and this procedure is repeated for any additional values of a desired.

Integral Form of the Blondel-Rey Equation

Shortly after the publication of their classic paper on abrupt flashes, Blondel and Rey took up the question of flashes having time distributions other than square. On purely intuitive grounds they proposed the following modification of their original equation for effective intensity

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{.21 + (t_2 - t_1)}. \qquad (4)$$

In this equation the numerator of the right side represents the light energy contained in the flash between the time limits of integration, t_1 and t_2. For the case where the flash is abrupt (square in shape) this reduces to the original equation

$$I_e = \frac{I(t_2 - t_1)}{.21 + (t_2 - t_1)} = \frac{It}{.21 + t}.$$

The difficulty with the integral equation proposed by Blondel and Rey is that there is an ambiguity about the choice of the time limits, t_1 and t_2. Blondel and Rey recognized this difficulty and could offer no rigorous solution for it. They did, however, suggest that t_1 and t_2 should be chosen as the times when I was equal to the threshold value of I for the case of steady illumination.

Recently Douglas* has proposed that the am-

*See Part II, paper by C. A. Douglas.

biguity in the selection of time limits in the integral form of the Blondel-Rey equation be resolved by selection of the limits so as to maximize I_e. When the limits of integration are so chosen, it turns out that the instantaneous value of intensity at these time limits is the steady light threshold intensity, exactly as proposed by Blondel and Rey in 1911. Douglas further shows that in general, for any value of a, the maximum value of I_e is obtained when the limits of integration are those values of t at which the instantaneous value of I is equal to I_e.

Oddly, although most practical flashing light sources do not produce abrupt flashes, Blondel and Rey's proposal of the integral form of their equation has been generally ignored since 1911. Stiles, Bennett, and Green[4] took note of the proposal in 1937, but commented that there had been little or no experimental verification of it. Blondel and Rey[2] themselves, in 1916, made some measurements of effective intensity on rotating beacons with abrupt square form flashes, and with non-abrupt flashes of both long and short duration. The conditions of their experimental work were such as to give imprecise results, but within the error of their measurements, they confirmed the original equation and the integral form of it. As Douglas has shown, the uncertainty in the computation of I_e resulting from the uncertainty in the choice of the limits of integration is not very large, especially for flashes of relatively short duration, so that experimental verification of the validity of the method of maximization of I_e is very difficult to obtain. The uncertainty of Blondel and Rey's measurements was so great that the choice of limits of integration had no significant effect on their results.

Neeland, Laufer, and Schaub,[5] in 1938, reported the results of a series of measurements of effective intensity of rotating beacons, with both square and non-square flash characteristics. They used the results of their measurements to compute the value of a in the Blondel-Rey equation, but fitted both the square and non-square flashes to equation (2). For the non-square flashes they took I as the peak of the candlepower-time distribution and t as the interval between those points on the distribution where the instantaneous intensity was 10 per cent of the peak intensity. They thus attributed much more energy to the flash than was actually there. The values of a they obtained for square-form flashes conformed fairly well with those obtained by others, but the values of a for the non-square flashes were significantly higher. If, however, their results are computed from the integral form of the equation, then the values of a are in approximate agreement with those obtained by others.

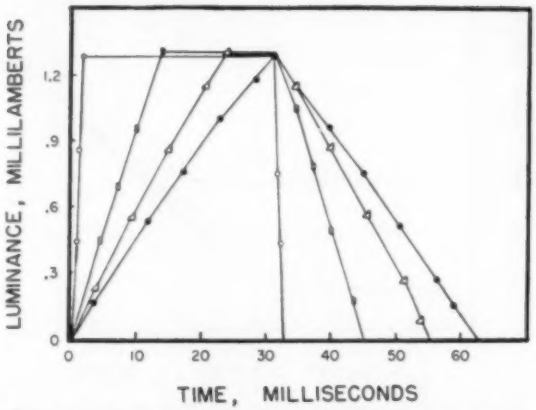


Figure 5. Curves showing four of the seven wave forms used by Long in determining the relation between wave form of a flash and effective intensity. The wave forms are so designed as to provide equal total flash energies.

In 1951, Long[10] reported an investigation of the relation between the wave form of the flash and the effective intensity. He used seven wave forms ranging from a square wave to a triangular wave. Fig. 5 shows four of the seven wave forms. The other three were intermediate in shape. The wave forms were so designed as to contain the same light energy per flash. The viewing condition was 15 degrees peripheral and the light source subtended a visual angle of 2 minutes. Long did not use the integral form of the Blondel-Rey equation nor did he concern himself with the choice of the limits of integration. He computed the total energy under the curve for each wave shape. Long felt that he was well within the range of reciprocity since his flash durations were quite short, and therefore looked only for the relation between the total

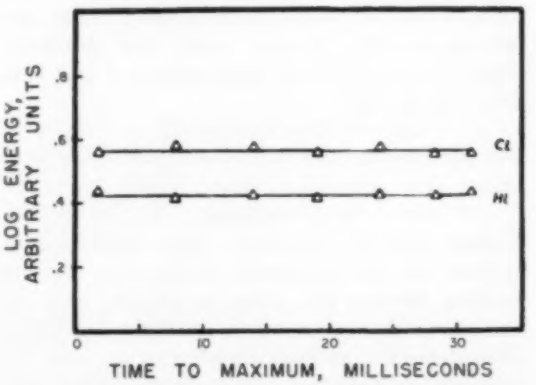


Figure 6. Flash energy required for threshold excitation for flashes of seven wave forms (four of them shown in Fig. 5) by two observers. The seven wave forms are distinguished by the time required for the intensity to rise to a maximum. (Long).

energy in the flash and the effective intensity. His results are shown in Fig. 6 (Long identified the different wave shapes by the time it took for the luminance to rise to a maximum.) It will be noted that the constancy of the energy required for threshold excitation with the different wave shapes was rather remarkable, in view of the experimental errors usually found in work of this kind.

It is of interest to consider Long's work from the point of view of Douglas' proposed method for computing I_e. For the case of the square form flash or the nearly square trapezoidal flashes, there is a negligibly small difference between I_e computed from the total energy and I_e maximized by Douglas' method. However, as the wave form becomes more nearly triangular, a larger difference may be expected. The computed difference for the triangular wave turns out to be about 10 per cent; that is, although the square form flash and the triangular form flash have equal total energy, I_e for the triangular flash is 10 per cent less than I_e for the square flash when both are computed from the integral form of the Blondel-Rey equation by Douglas' method of maximization. However, this difference amounts to only about 0.05 log unit on the ordinate scale of Fig. 6 and it is evident therefore that Long's results are not greatly affected by the change in the method of computing I_e.

Extremely Short Flashes

As shown above, the relation between intensity and duration is reciprocal, according to the Blondel-Rey equation, for flashes with durations appreciably shorter than the "critical duration." It has been suggested, especially since the introduction of electronic flash lamps with flash durations of the order of fractions of a millisecond, that the reciprocity relationship does not hold for extremely short flashes, and that such flashes have higher effective intensity than that which would be predicted from the Blondel-Rey equation. On the other hand, some early research workers obtained results that suggested a failure of reciprocity in the other direction for short flashes, that is, the effective intensity was less than I_e computed from the Blondel-Rey equation. Reeves,[6] for example, in 1918, found that it took about half again more energy in a flash at a duration of two milliseconds than in a flash of 10 milliseconds duration to obtain threshold illuminance. Piéron,[7,8] in 1920, found a similar reciprocity failure, although his results were less consistent. Stiles, Bennett, and Green,[4] in 1937, expressed doubt as to the validity of the inference of reciprocity drawn by Piéron and Reeves from their data. It appears likely, in view of the absence of any reciprocity failure in the results obtained in other work, most of it carried out with considerably more care, that the experimental error in the work of Piéron and Reeves was sufficiently great that an inference of reciprocity could have been drawn as validly as one of failure of reciprocity. Their papers furnished only sparse information as to experimental techniques, but it is likely for example that there may have been substantial errors in their measurements of the durations or energies of short flashes. Baumgardt,[9] in 1949, measured effective intensity in the duration range from four microseconds to one millisecond and found reciprocity throughout this range. His results are shown in Fig. 7.

The weight of the evidence for reciprocity is sufficiently great as to offer no support for the existence of a failure of reciprocity in either direction with any light sources now in use.

Above Threshold Illuminances

Blondel and Rey observed during the course of their work on threshold measurements that a short duration flash that appeared equal in intensity to a long duration flash at threshold, appeared noticeably more intense than the long flash when the illuminance at the eye was well above threshold. They did not, however, pursue the question raised by this observation. Toulmin-Smith and Green,[13] in 1933, reported the results of a series of experiments with dark-adapted observers in which eye illuminances were varied from 0.2 mile-candle (slightly above threshold) to 4.0 mile-candles. In connection with signal lights used in navigation, the concept of "useful" threshold had been developed, as a measure of the lower limit of illuminance at which, under practical conditions, reliable recognition of the existence of light signals might be expected. It is generally agreed that this is in the neighborhood of 0.5 mile-candle, although under the variable conditions so often found in practice, wide departures from this value may be found. (Toulmin-Smith and Green used the rather overprecise value of 0.425 mile-candle as the "useful" threshold.) Their range of illuminances was therefore from about ½ to about 10 times the "useful" threshold, and bracketed fairly well the range of illuminances in which signal sightings usually occur. The flash durations were from 0.05 to 0.5 seconds. Fig. 8 shows the data obtained at an illuminance of 0.5 mile-candle and indicates the spread of the individual observations. Fig. 9 shows the family of curves obtained at the five illuminance levels tested. The Blondel-Rey equation for threshold illuminance is plotted in the figure and

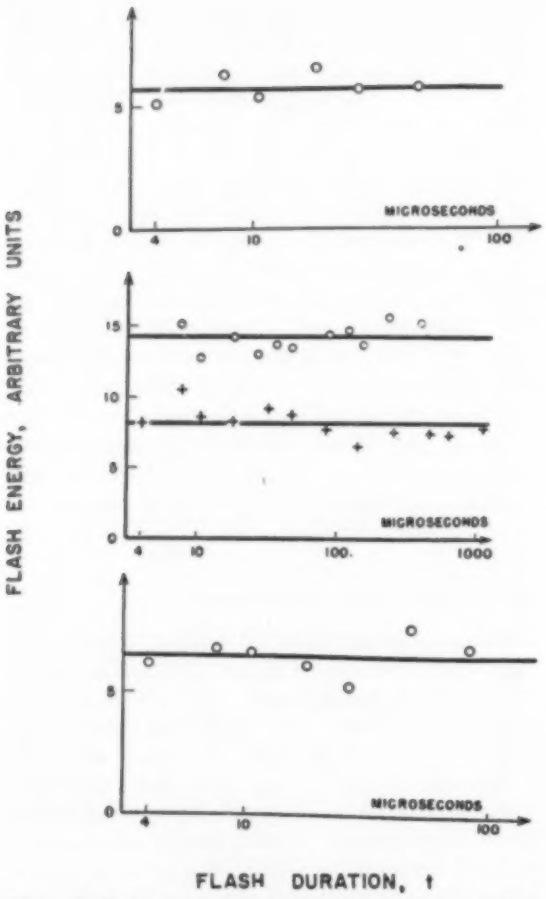


Figure 7. Flash energy required for threshold excitation 12° from the fovea as a function of flash duration, t, for values of t between 4 microseconds and 1 millisecond. Data for four observers. (Baumgardt)

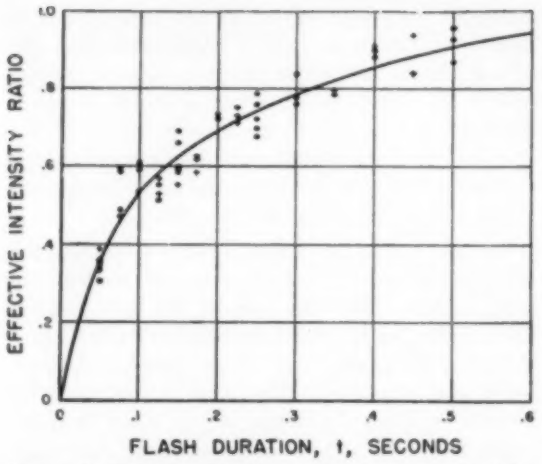


Figure 8. Effective flash intensity relative to fixed intensity, as a function of flash duration, t, for each of two observers, at an illuminance of 0.5 mile-candle. (Toulmin-Smith and Green).

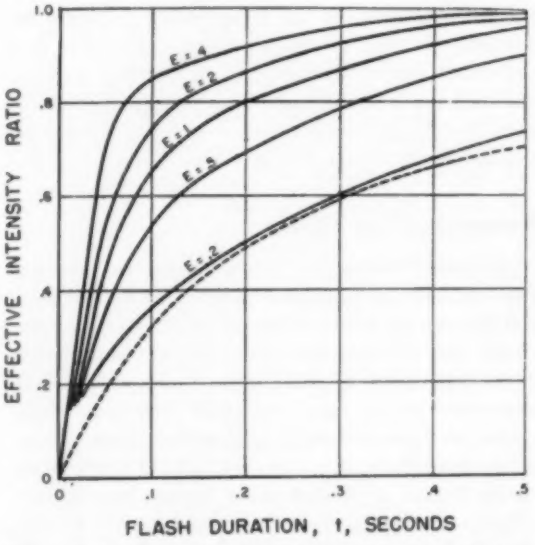


Figure 9. Effective flash intensity relative to fixed intensity, as a function of flash duration, t, at illuminances $E = 0.2$, 0.5 (data shown in Fig. 8), 1, 2, and 4 mile-candles. The dashed curve is the Blondel-Rey equation (equation 1) for threshold illuminance (Toulmin-Smith and Green).

shows very close correspondence to the experimental curve at 0.2 mile-candle. Toulmin-Smith and Green tried to determine an equation of close fit to their data for the "useful" threshold at 0.425 mile-candle (obtained by interpolation from their experimental results) as shown in Fig. 10, in which are plotted the Blondel-Rey equation, interpolated test data for 0.425 mile-candle, and the fitted curve for the equation

$$\frac{I_e}{I} = 1.1\,\frac{t}{.15+t}. \qquad (5)$$

Hampton[14] in 1934 objected to the Toulmin-Smith and Green equation because of the coefficient 1.1, asserting that an adequate fit to all of their data could be obtained by an equation in the Blondel-Rey form with the constant, a, treated as a function of the illuminance level. On this assumption, he plotted Toulmin-Smith and Green's data as shown in Fig. 11, and from this obtained the equation,

$$\frac{I_e}{I} = \frac{t}{(.0255/E)^{.81}+t} \qquad (6)$$

where E, the illuminance at the observer, is given in mile-candles. In this equation, a has the follow-

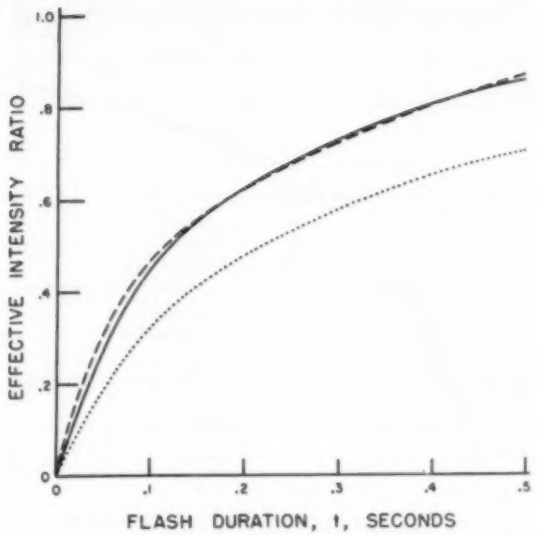


Figure 10. Curve fitted to test data at 0.425 mile-candle ("useful" threshold) by Toulmin-Smith and Green. The dashed curve is the test data, obtained by interpolation from the data represented by the curves of Fig. 9. The solid curve is the fitted equation (equation 5). The lower dotted curve is the Blondel-Rey equation (equation 1) for threshold illuminance.

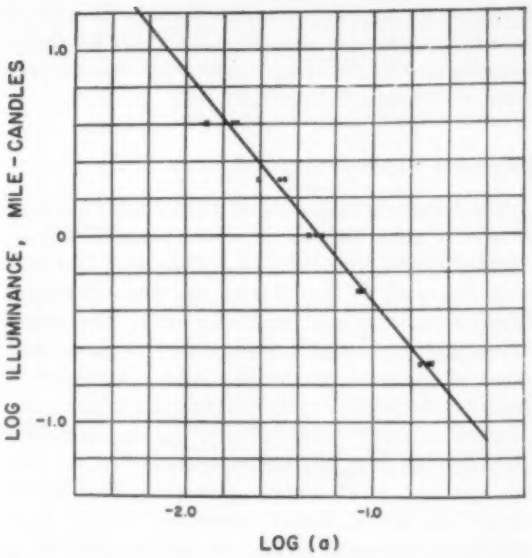


Figure 11. Relation between the value of a and the illuminance, plotted by Hampton on the assumption that the Toulmin-Smith and Green data could be represented by the Blondel-Rey equation (equation 1).

ing values at the illuminance levels used in the original experiments:

Illuminance, Mile-Candles	a
.2	.19
.5	.09
1.0	.05
2.0	.03
4.0	.017

Hampton then replotted the original curves, using his equation, and obtained the curves of Fig. 12, not significantly different from those of Toulmin-Smith and Green (Fig. 9).

In Fig. 13, Hampton compared his equation (equation 6), Toulmin-Smith and Green's formula (equation 5), and the experimental data for 0.425 mile-candle. None of the differences is significant, in view of the experimental errors inherent in this type of measurement.

Apart from the work of Toulmin-Smith and Green, there appears to have been no systematic effort to ascertain the relationship between effective intensity and illuminances above threshold. Some qualitative observations and occasional rough measurements[1,2,12] have shown that effective intensity is relatively greater above threshold than at threshold, but have not confirmed with any precision the values of a calculated by Hampton from the data of Toulmin-Smith and Green. On the other hand, Schuil,[15] in the course of some work in which the value of a was incidental, noted that he did not confirm the Toulmin-Smith and Green value of a at an illuminance of 2.0 mile-candles although he did confirm it at 0.5 mile-candle. He did not give any details nor did he mention the extent of the disagreement. In the absence of any definitive work calling for a modification, it appears that

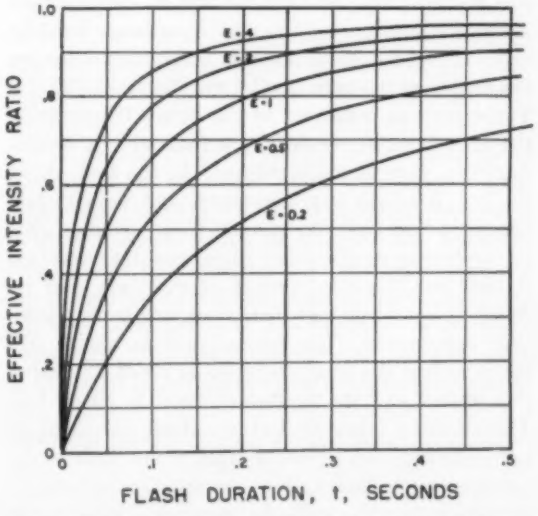


Figure 12. Representation of Toulmin-Smith and Green data (Fig. 9) as recast by Hampton in the form of the Blondel-Rey equation, with the value of a empirically determined from the data (equation 6).

Hampton's equation (equation 6) should be used in calculating effective intensity for above-threshold illuminances in the range covered by the observations of Toulmin-Smith and Green.

Repeated Flashes

The foregoing discussion of light flashes has considered a light flash as an isolated event in time, and the effective intensity of such isolated flashes is well described by the Blondel-Rey law. If flashes occur in more or less rapid succession, interaction effects may occur and it is of interest to know what these effects are. Many flashing signals used in practice do involve repetitive flashing signals, for example, aircraft "anti-collision" lights, traffic obstruction markers, lighthouse beacons, etc., so that the question is of some importance. For flashes above the critical flicker frequency, that is, at a repetition rate great enough so that the observer is unaware of the discontinuous character of the signal, Talbot's law holds, and the apparent intensity is equal to the average intensity. Under such conditions, it is immaterial how the luminous energy is distributed in time: two light sources with distributions whose time averages of intensity are equal will appear equally intense. Schuil[15] investigated this problem for flashes of $^1/_{10}$ and $^1/_{40}$ second duration, and with repetition rates from one per second up to frequencies well above the limit of noticeable flicker. In his experimental procedure he kept the flash duration constant (at either $^1/_{10}$ or $^1/_{40}$ second) and varied the duration of the dark interval between flashes. Thus the energy per flash was constant but the time average of the intensity increased as the dark interval decreased. Schuil's results, for an instantaneous illuminance during the flashes of 0.5 mile-candle, are shown in Fig. 14. Three regions, indicated in the figure for curve 2, the experimental results for a flash of $^1/_{40}$ second duration, may be distinguished. In the first, A, at the left, the light appears steady, and Talbot's law (curve 4 for the $^1/_{40}$ second flash) holds. This region begins at the point where the dark interval is zero and the total period of the flash and its duration are equal, the light therefore being physically continuous. The region ends at about .075 second when the repetition rate is about 13 flashes per second and the light-dark ratio is about 1:3. The effective intensity is then about one-third of the instantaneous intensity during the flash in accordance with Talbot's law. As the dark interval is increased further and the repetition rate correspondingly decreased (B), flicker is observed until the period is about 0.2 second long, corresponding to a repetition rate of five flashes per second. Beyond this point (C) the flashes are observed as more or less distinctly separate, and the effective intensity levels off to a value equal to that called for by the Blondel-Rey equation, with the value for a computed by Hampton from the data of Toulmin-Smith and Green. The data show a smooth transition from the region at the left where Talbot's law holds to the region at the right where the effective intensity of the flashes is equal to that of isolated flashes in accordance with the Blondel-Rey law. Schuil observed, however, as noted previously, that while the general relationship between effective intensity and repetition rate which he obtained at 2.0 mile-candles was similar to that obtained at 0.5 mile-candle, the effective intensities for the limiting frequencies at the right differed from those of Toulmin-Smith and Green.

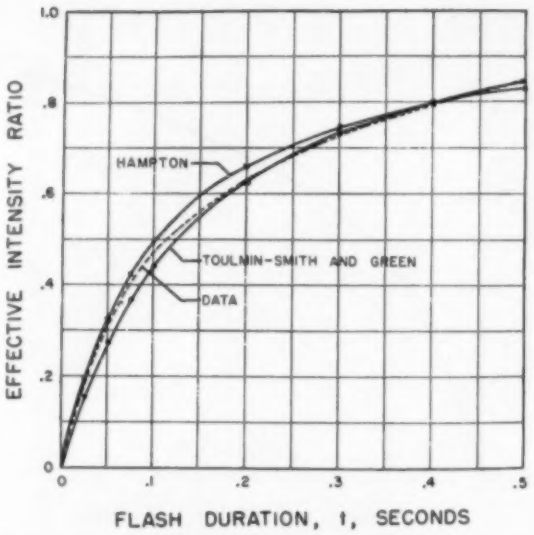


Figure 13. Comparison of Toulmin-Smith and Green equation, Hampton equation, and data, at illuminance of 0.425 mile-candle. (Hampton)

Although Schuil's work shows a smooth transition from the region of Talbot's law to the region of the Blondel-Rey law, some other work suggests that at certain middle frequencies in the flickering range, the effective intensity is actually greater if a steady burning light is occulted than if it is viewed constantly. Bartley[16] found for example that at a repetition rate of about 8 or 9 flashes per second, a flashing field of view was matched in apparent brightness with a similar steady field when the luminance of the flashing field was only about 60 per cent of the luminance of the steady field. This result was obtained with a steady field luminance of about 300 footlamberts and a light-dark ratio for the flashing field of 1:1. Bartley did not give

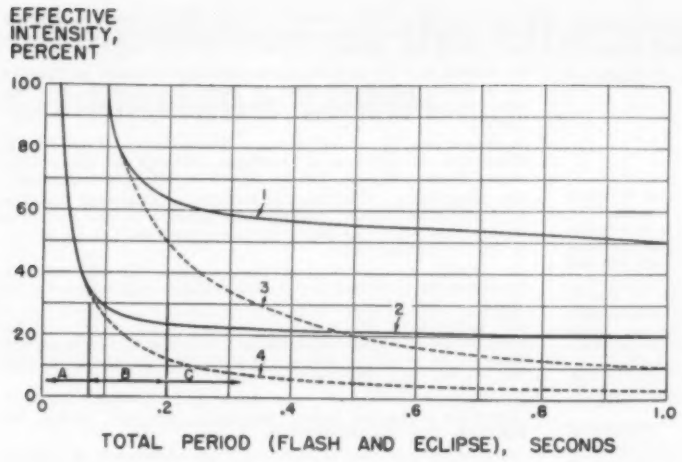


Figure 14. Effective intensity of flash relative to fixed intensity, for repeated flashes, as a function of the period of the flash cycle, with the flash duration kept constant and the eclipse time varied to obtain different repetition rates. (Schuil).

Curve 1, experimental curve for 1/10 second flash.

Curve 2, experimental curve for 1/40 second flash.

Curve 3, Talbot's law for 1/10 second flash.

Curve 4, Talbot's law for 1/40 second flash.

(*Note:* Three regions for curve 2 are distinguished: A, in which the light appears steady, B, in which the light appears to flicker, and C, in which the flashes are seen as separate and distinct.)

any data as to the size of the fields viewed, but it is presumed that the fields had some extent since he dealt with them in terms of luminance rather than intensity. Bartley gave data only for the results obtained with the 300-footlambert steady field, but noted that he obtained essentially similar results with steady field luminances from about 14 to about 1200 footlamberts. It will be noted that Bartley's minimum luminance was very far above threshold: 500 times threshold even for a light-adapted observer. Schuil, on the other hand, worked close to threshold. The author has carried out rough measurements which confirm the smooth transition found by Schuil in the low illuminance region. It appears likely that at illuminance levels where the concept of effective intensity is useful repetitive flashes that appear separate and distinct from each other may be treated in accordance with the Blondel-Rey law.

Conclusions

Since it was first proposed in 1911, the Blondel and Rey equation

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{a + (t_2 - t_1)}$$

defining the effective intensity of a flashing light in terms of the duration of the flash and the instantaneous intensity during the flash has become well established. A considerable body of research has verified the general validity of the equation over a large range of observing conditions. There are nevertheless many areas where the precise application of the equation is in some doubt and where considerably more work is called for in order to establish valid relationships or to confirm relationships at present only poorly supported.

For point sources of non-chromatic light, foveally viewed at threshold with the dark-adapted eye, Blondel and Rey's value of about 0.2 for the constant, a, seems fairly well established, although somewhat higher and lower values have been reported, ranging from about 0.15 to 0.25. The inherent lack of precision of measurements in this field suggests that the value of 0.2 be used in all computations as representative of the values most often found. Observations of flashing lights not falling within the narrow confines set forth above, for example, lights that are chromatic, or with some extent, or viewed peripherally, seem to be subject to more or less the same relationship as long as effective intensity is defined in terms of the same source burned steadily and viewed under the same conditions.

The general effect of raising the illuminance at the eye above threshold or of providing a light background against which the lights are viewed is to lower the value of a in the Blondel-Rey equation. For the case of above-threshold viewing of flashing lights against a dark background, values of a related to illuminance at the eye have been established, but considerably more work could be done in this area to put these values on a firmer foundation. Because of the critical dependence of the threshold illuminance on the conditions of observation, it may be profitable in research work to relate the results to the steady light threshold for the same conditions of observation.

Finally it seems clear that the concept of effective intensity should be limited in application to

low levels of illuminance, with the illuminance here considered as a multiple of the marginal amount of illuminance necessary to distinguish a flashing light from its background.

References

1. Blondel, A., and Rey, J.: "The Perception of Lights of Short Duration at Their Range Limits," *Transactions*, IES, London, Vol. VII, No. 8, p. 625, (November 1912). This paper is a complete account in English of the material contained in two papers published in 1911 in the *Journal de Physique*, Vol. I, Series 5, page 530 and page 643.

2. Blondel, A., and Rey, J.: "Comparaison, au point de vue de le portée, des signaux lumineux brefs produit, au moyen d'un appareil rotatif, par des sources de lumière donnant des durées d'impression différent. Conditions d'efficacité maxima du flux lumineux utilisé," Comptes Rendus, Vol. 162, page 861, (1916).

3. Langmuir, I., and Westendorp, W. F.: "Study of Light Signals in Aviation and Navigation," *Physics*, Vol. 1, No. 5, p. 273, (November 1931).

4. Stiles, W. S., Bennett, M. G., and Green, H. N.: "Visibility of Light Signals with Special Reference to Aviation Lights. (Review of Existing Knowledge)," Aeronautical Research Committee Reports and Memoranda No. 1793, May 11, 1937.

5. Neeland, G. K., Laufer, M. K., and Schaub, W. R.: "Measurement of the Equivalent Luminous Intensity of Rotating Beacons," *Journal of Optical Society of America*, Vol. 28, No. 8, p. 280, (August 1938).

6. Reeves, P.: "The Effect of Size of Stimulus and Exposure Time on Retinal Threshold," *Astrophysical Journal*, Vol. XLVIII, p. 141, (April 1918).

7. Piéron, H.: "De la Variation de l'Énergie Liminaire en Fonction de la Durée d'Excitation pour la Vision Foveale," *Comptes Rendus*, Vol. 170, p. 525, (1920).

8. Piéron, H.: "De la Variation de l'Énergie Liminaire en Fonction de la Durée d'Excitation pour la Vision Périphérique, (Loi des Cônes et Loi des Bâttonets)," *Comptes Rendus*, Vol. 170, p. 1203, (1920).

9. Baumgardt, E.: "Les Théories Photochimique Classiques et Quantiques de la Vision et l'Inhibition Nerveuse en Vision Liminaire," *Revue d'Optique*, Vol. 28, No. 12, p. 661, (December 1949).

10. Long, G. E.: "The Effect of Duration of Onset and Cessation of Light Flash on the Intensity-Time Relation in the Peripheral Retina," *Journal of the Optical Society of America*, Vol. 41, No. 11, p. 743, (November 1951).

11. Brown, R. H.: "Velocity Discrimination and the Intensity-Time Relation," *Journal of the Optical Society of America*, Vol. 45 No. 3, p. 189, (March 1955).

12. Leibowitz, H. W., Meyers, N. A., and Grant, D. A.: "Radial Localization of a Single Stimulus as a Function of Luminance and Duration of Exposure," *Journal of the Optical Society of America*, Vol. 45, No. 2, p. 76, (February 1955).

13. Toulmin-Smith, A. K., and Green, H. N.: "The Fixed Light Equivalent of Flashing Lights," *Illuminating Engineer*, London, Vol. XXVI, p. 304, (December 1933).

14. Hampton, W. M.: "The Fixed Light Equivalent of Flashing Lights," *Illuminating Engineer*, London, Vol. XXVII, p. 46, (February 1934).

15. Schuil, A. E.: "The Effect of Flash Frequency on the Apparent Intensity of Flashing Lights Having Constant Flash Duration," *Transactions, IES*, London, Vol. V, No. 8, p. 117, (1940).

16. Bartley, S. H.: "Subjective Brightness in Relation to Flash Rate and the Light-Dark Ratio," *Journal of Experimental Psychology*, Vol. 23, No. 3, p. 313, (September 1938).

Discussion of this paper is included with that of the following, companion paper and begins on page 646.

Next Year's Conference Papers

Deadline for outlines of next year's conference papers will be December 31, 1957. The earlier date of the conference next year (August 17-22, 1958) has necessitated an earlier deadline for the Papers Committee consideration of proposed papers. Those wishing to present papers before the 1958 conference in Toronto should submit outlines of them, not later than December 31, 1957, to:

Mr. H. F. Davidson, Chairman, Papers Committee
Curtis Lighting of Canada, Ltd.
195 Wicksteed Ave.
Leaside, Toronto 17, Ont.

Computation of the Effective Intensity Of Flashing Lights

By CHARLES A. DOUGLAS

It is generally recognized that when a light signal consists of separate flashes, the instantaneous intensity during the flashes must be greater than the intensity of a steady light in order to obtain threshold visibility. Blondel and Rey[1] found that the threshold illuminance for an abrupt flash (a flash producing a relatively constant illuminance throughout its duration) is

$$E = E_o(a+t)/t, \qquad (1)$$

where E_o is the threshold illuminance for a steady light, t is the flash duration, and a is a constant. They found that a was equal to 0.21 when t is in seconds.

It is convenient to evaluate flashing lights in terms of their effective intensity, I_e, that is, the intensity of a fixed light which will appear equally bright. Then

$$I_e = I E_o/E$$

where I is the instantaneous intensity producing the illuminance, E,

$$I_e = \frac{It}{a+t}. \qquad (2)$$

Later Toulmin-Smith and Green[2] found that somewhat different effective intensities were obtained when the illuminance at the eye was above threshold. However, Hampton[3] showed that their experimental results could be adequately expressed by equation (2) when a is a function of the illuminance at the eye.

The flash from most lights used in aviation service, such as airway beacons and anti-collision lights, is not abrupt. The instantaneous intensity often rises and falls gradually and may vary appreciably during the flash. If the flash duration is very short or if the times of rise and fall of intensity are short in comparison to the flash duration, only small uncertainties would be introduced in the determination of flash duration and by the use of the product of the peak intensity during the flash and the flash duration for the quantity It. However, in many cases significant errors would be introduced. Some modification of equation (2) is therefore required.

Some of the specifications for flashing lights have evaluated their signals in terms of the candle-seconds in the flash, integrating over a period of not more than 0.5 second, that is

$$\text{Candle-seconds} = \int_{t_1}^{t_2} I\,dt$$

where I is the instantaneous intensity and $t_2 - t_1$ does not exceed 0.5 second. This method of evaluation provides a measure of comparison between lights of roughly the same intensity variation with time but is not suited to the comparison of lights of different flash characteristics nor to the computation of visual ranges.

Others have used the relation

$$I_e = \frac{I_{max}t}{a+t},$$

where I_{max} is the maximum instantaneous intensity during the flash and t is the flash duration. Often the value of a is adjusted for the characteristics of the flash so that the computed value of I_e is in reasonable agreement with the observed value.

When the specification for aircraft anti-collision lights was being drafted, it was suggested that a modified form of equation (2) be used for the computation of effective intensity, so that

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{.2+t_2-t_1}. \qquad (3)$$

An equation of this form was originally suggested by Blondel and Rey,[4] but has rarely been used.

The question of choice of limits was immediately raised. Rather than use an arbitrary set of limits, such as choosing for t_1 and t_2 the times when I was 10 per cent of the peak of the flash, a choice of limits which would make I_e a maximum was suggested. This immediately poses the problem of developing a method, other than trial and error, of obtaining the maximum value of I_e. The development of such a method is the purpose of this paper.

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 9-13, 1957, Atlanta, Ga. AUTHOR: Photometry and Colorimetry Section, National Bureau of Standards, Washington, D. C. This paper was prepared as a part of the work in the development of aviation ground lighting conducted at the National Bureau of Standards under the sponsorship of the Visual Landing Aids Branch of the Bureau of Aeronautics and the Lighting Section, Aeronautics Accessories Laboratory, Wright Air Development Center. Accepted by the Papers Committee of I.E.S. as a Transaction of the Illuminating Engineering Society.

Fundamental Theorems

The method of obtaining the maximum value of I_e will be developed by means of one theorem and two corollaries. The proofs follow.

Theorem. *I_e is a maximum when the limits t_1 and t_2 are the times when the instantaneous intensity is equal to I_e.*

This theorem may be readily proved by application of the calculus of variations.* The proof given below is included because of the application of the method and equations used to later sections of the paper.

Consider instantaneous intensity, I, in a flash as any continuous, non-negative, single-valued function of time such that I is less than I_e in the intervals t''_1 to t_1 and t_2 to t''_2, and I is greater than I_e in the intervals t_1 to t'_1 and t'_2 to t_2, where $t''_1 < t_1 < t'_1 < t'_2 < t_2 < t''_2$, and I_e is defined in equation (4):

$$I_e = \frac{\int_{t_1}^{t_2} I\,dt}{a + t_2 - t_1}. \tag{4}$$

Fig. 1 shows I as a function of t for a simple one-peak flash meeting these requirements.

Case I.

Consider the case where the integration is performed over the time interval t'_1 to t'_2 which lies within the interval t_1 to t_2.

Then the intensity I' at the times t'_1 and t'_2 is greater than I_e.

$$I' > I_e.$$

Let

$$I'_e = \frac{\int_{t'_1}^{t'_2} I\,dt}{a + t'_2 - t'_1}.$$

Then

$$\int_{t_1}^{t_2} I\,dt = \int_{t_1}^{t'_1} I\,dt + \int_{t'_1}^{t'_2} I\,dt + \int_{t'_2}^{t_2} I\,dt,$$

so that

$$I_e(a + t_2 - t_1) = \int_{t_1}^{t'_1} I\,dt + I'_e(a + t'_2 - t'_1) + \int_{t'_2}^{t_2} I\,dt.$$

But

$$\int_{t_1}^{t'_1} I\,dt > I_e(t'_1 - t_1), \tag{5a}$$

and

$$\int_{t'_2}^{t_2} I\,dt > I_e(t_2 - t'_2). \tag{5b}$$

Substituting and combining terms, we have

$$I_e(a + t'_2 - t'_1) > I'_e(a + t'_2 - t'_1).$$

Therefore

$$I_e > I'_e. \tag{6}$$

*The author is indebted to Dr. H. H. Seliger of the National Bureau of Standards for an elegant proof using the calculus of variations.

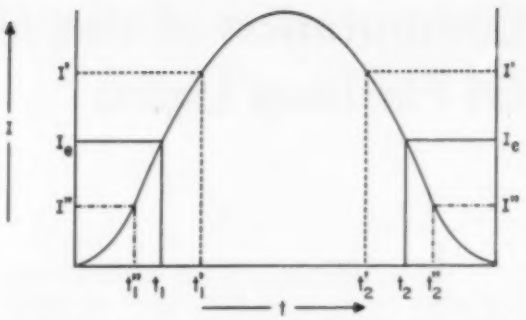


Figure 1. Intensity-time distribution of simple flash. (See text.)

Case II.

Consider now the case where the integration is performed over the time interval t''_1 to t''_2, which includes the interval t_1 to t_2.

Then the intensity I'' at the times t''_1 and t''_2 is less than I_e.

$$I'' < I_e.$$

Let

$$I''_e = \frac{\int_{t''_1}^{t''_2} I\,dt}{a + t''_2 - t''_1}.$$

Then

$$\int_{t''_1}^{t''_2} I\,dt = \int_{t''_1}^{t_1} I\,dt + \int_{t_1}^{t_2} I\,dt + \int_{t_2}^{t''_2} I\,dt,$$

and

$$I''_e(a + t''_2 - t''_1) = \int_{t''_1}^{t_1} I\,dt + I_e(a + t_2 - t_1) + \int_{t_2}^{t''_2} I\,dt. \tag{7}$$

But

$$\int_{t''_1}^{t_1} I\,dt < I_e(t_1 - t''_1), \tag{8a}$$

and

$$\int_{t_2}^{t''_2} I\,dt < I_e(t''_2 - t_2). \tag{8b}$$

Substituting and combining terms, we have

$$I_e > I''_e. \tag{9}$$

Thus I_e is greater than both I'_e and I''_e. Therefore, the maximum value which can be obtained from the Blondel-Rey relation, equation (4), is that obtained when the intensity at the beginning and end of the interval of integration is equal to the effective intensity.

Corollary 1. *If the instantaneous intensity is integrated over a period of time t'_1 to t'_2 shorter than t_1 to t_2, and I' is the instantaneous intensity at these times, a value I'_e is obtained for the effective intensity that is always less than I'.*

From equation (6) we have

$$I_e > I'_e.$$

But

$$I' > I_e.$$

Therefore

$$I' > I'_e. \tag{10}$$

Corollary 2. *If the instantaneous intensity is integrated over a period of time t''_1 to t''_2 longer than t_1 to t_2, and I'' is the instantaneous intensity at the times t''_1 and t''_2, a value I''_e is obtained for the effective intensity that is always greater than I''.*

From equation (7) we have

$$I''_e(a+t''_2-t''_1)=\int_{t''_1}^{t_1} I\,dt+I_e(a+t_2-t_1)+\int_{t_2}^{t''_2} I\,dt.$$

But

$$\int_{t''_1}^{t_1} I\,dt > I''(t_1-t''_1),$$

and

$$\int_{t_2}^{t''_2} I\,dt > I''(t''_2-t_2).$$

Also

$$I_e(a+t_2-t_1) > I''_e(a+t_2-t_1).$$

Substituting these into equation (7) and simplifying, we have

$$I''_e > I''. \tag{11}$$

Computations of Effective Intensity

Guides for the computation of the effective intensity from an intensity-time distribution curve may be obtained from the theorem and corollaries.

a. Computation of I_e

1. Make an estimate I' of the value of the effective intensity and solve equation (3) using the values of t corresponding to this intensity, obtaining I_{e_1}.

2. Repeat step 1 above, using as limits the values of t corresponding to the I_{e_1} obtained in step 1, obtaining I_{e_2}. Repeat as often as necessary to obtain the desired accuracy.

Note that if the estimated effective intensity is too high (I' in Fig. 1), the effective intensity, I_{e_1}, computed in step 1 will be below I_e (I'' of Fig. 1) and thus I_e lies between I' and I_{e_1}. If the initial estimate is lower than I_e (I'' of Fig. 1), I_e will be greater than both I'' and I_{e_1} and a "straddle" is not obtained but I_e is approached continuously from the low side.

b. Determination of Conformance of a Flashing Light to Specification Requirements

1. Compute I_{e_1} using the time limits corresponding to the specified effective intensity I_s. If I_{e_1} is greater than I_s, the unit obviously complies, for the conditions are those of Fig. 2a (corollary 2).

2. If I_{e_1} is equal to I_s, the unit just complies, for then $I_e = I_s = I_{e_1}$ (theorem).

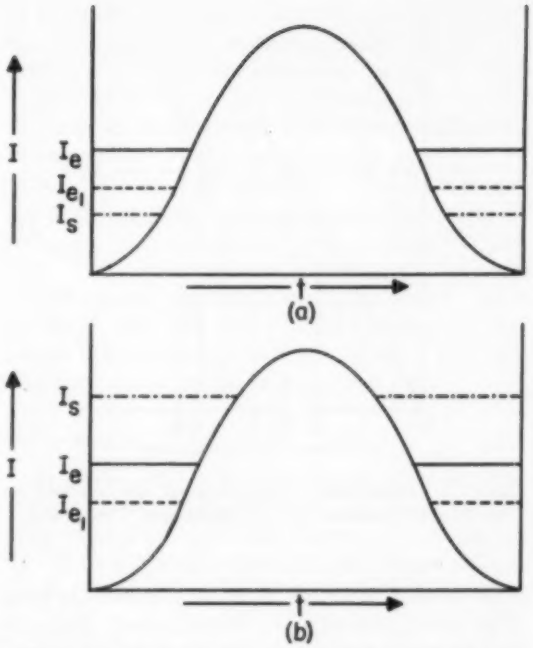


Figure 2. Illustrating the method of determining conformance to specification requirements of effective intensity. (See text.)

3. If I_{e_1} is less than I_s, the unit fails for then the conditions are those of Fig. 2b (corollary 1).

Note that the degree by which the unit exceeds or fails to meet the specification requirements is *not* given by the single computation described here. The method outlined in section *a* must be used for this purpose.

c. Visual Range Computations

If the visual range of the light, under specified conditions of transmittance and threshold, is desired, compute the effective intensity by using the method outlined in section *a* and compute the visual range by using Allard's Law.

If the problem is only the determination of whether the light can be seen at a given distance under specified conditions of transmittance and threshold, use Allard's Law to compute the fixed intensity required to make the source visible at this distance. Then, by using the method outlined in section *b*, determine if the effective intensity of the unit exceeds this intensity.

Application to Complex Intensity-Time Curves

Not all units have single-peak intensity-time distribution curves similar to the curve shown in Fig. 1. Consider an intensity-time distribution curve of the type whose rise is shown in Fig. 3 where I_b

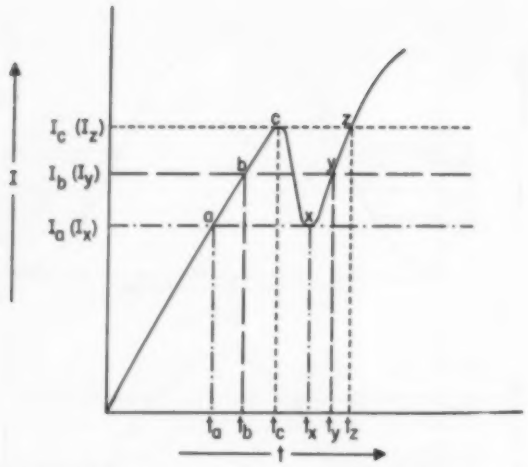


Figure 3. Illustrating application of the method to multi-peak intensity-time distributions. (See text.)

is the average intensity in the time interval t_b to t_y. (The time interval $t_z - t_c$ is sufficiently short so that the momentary decrease in intensity is not visible.) If I_e is less than I_a or is greater than I_z, then the restrictions on the shape of the curve stated in theorem 1 are met and there is no problem in the determination of I_e.

Consider the case where I_e lies between I_a and I_z. It may be easily shown by means of equations (5) and (8) that as the shape of other parts of the intensity-time distribution curve changes, the lower limits of time to be used to obtain the maximum value of equation (4) will lie between t_a and t_b or between t_y and t_z and will never lie between t_b and t_y. If I_e is equal to I_b, then either t_b or t_y can be used as the lower limit.

Application to Groups of Short Flashes

In general a signal from a flashing light consists of regularly spaced single flashes of light and the interval between flashes is so great that each flash has little influence on the effective intensity of the adjoining flashes.

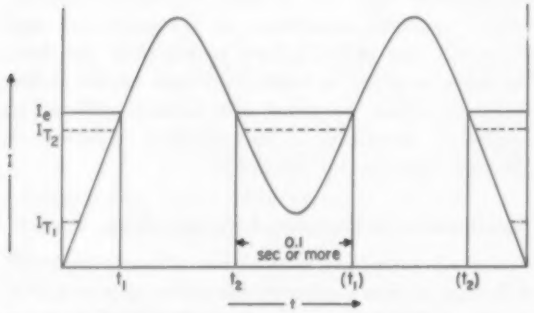


Figure 4. Illustrating application of the method to two-peak intensity-time curves. (See text.)

Consider first a flash with the intensity-time distribution shown in Fig. 4. This flash is similar to that of the "split-beam" beacon used at military airfields. If the threshold intensity required to make a steady light visible is much less than I_e (I_{T_1}), the flash will be seen as a continuous flash with two peaks. However, if the threshold intensity is about equal to I_e (I_{T_2}), two separate flashes will be seen. The maximum distance at which the light can be seen will be determined by the effective intensity of a single flash computed over the time interval t_1 to t_2.

There are lights that produce a number of very short flashes in rapid succession so that this group of flashes is seen as a single flash. An example of a light of this type is a unit using a number of condenser-discharge lamps to produce a single flash.

There appear to be no published data reporting studies of the effects of groups of flashes where the interval between flashes is short. Behavior of the eye under somewhat similar conditions suggests that if in a group of flashes the periods during which the instantaneous intensity of the light is below the effective intensity of the flash are of the order of 0.01 second or less, the eye will perceive this group as a single flash. The effective intensity of the group should then be computed by equation (12), choosing as times t_1 and t_2 the first and the last times the instantaneous intensity is I_e.

$$I_e = \frac{\int_{t_1}^{t_a} I\,dt + \int_{t_b}^{t_c} I\,dt + \int_{t_d}^{t_e} I\,dt + \int_{t_f}^{t_2} I\,dt}{a + t_2 - t_1}. \qquad (12)$$

Note that I_e is the effective intensity of the group and not that of a single flash.

If the periods during which the effective intensity is less than I_e are of the order of 0.1 second or more, it is believed that the individual flashes will be seen. Therefore, the effective intensity should then be computed on the basis of a single flash.

When the dark period is between 0.01 and 0.1 second, the effective intensity will lie between that of a single flash and that of the group. The behavior during the transition is not known.

Numerical Examples

Although the precise determination of the maximum value of I_e may appear laborious, it is relatively easy. Since a change in the times chosen as the limits in equation (4) changes the denominator and the numerator in the same direction, it is not necessary to determine the correct limits, t_1 and t_2,

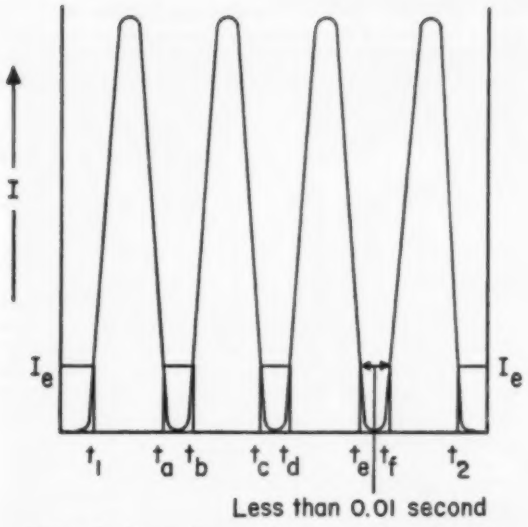


Figure 5. Illustrating application of the method to multiple flashes.

with great precision in order to obtain a satisfactorily precise determination of I_e. This is illustrated in Fig. 6 which shows two representative intensity-time distributions, one for a flashing light with a flash duration of about one-quarter second, and one with a flash duration of about one-twentieth second. The values of I_e are computed for seven sets of time limits. The values obtained are indicated at the abscissa of the time limits. The middle value of each group is the maximum I_e computed according to the method outlined above. Note that this value is equal to the instantaneous intensity at the corresponding time limits. Typically, the maximum effective intensity occurs lower on the curve for the short duration flash than for the long one and the variation of computed values of effective intensity with changes in time limits is smaller.

Experience indicates that if the times chosen for the initial integration are the times when the instantaneous intensity is about 20 per cent of the peak intensity, only one additional step is required to obtain a value for the effective intensity which is within one or two per cent of the maximum value. This is within the limits of accuracy with which the integral is evaluated by means of a planimeter. Often a single computation is sufficient if, instead of using as limits for the initial integration the times when I_e is 20 per cent of the peak intensity, the times used are the times when the instantaneous intensity is equal to the product of the peak intensity and the number of seconds between the times when the instantaneous intensity is roughly five per cent of the peak intensity.

The maximum value of I_e for the curves of Fig. 6 were computed by using as limits for the first integration the times corresponding to an intensity equal to about 20 per cent of the peak intensity and as limits for each succeeding integration the times corresponding to the instantaneous intensity obtained from the preceding step. (The curves have the shape of probability curves so the values of integrals may be computed with the desired accuracy. The accuracy is not limited by the accuracy of planimetric measurements.) Successive values for I_e of 1.66, 1.75, and 1.75 kilocandles were obtained for the longer flash and of 3.41, 3.42, and 3.42 kilocandles for the shorter flash.

Discussion

As noted above, concern has frequently been expressed about the choice of the limits for the integral of the Blondel-Rey relation for computing the visual range of a flashing light. It seems illogical to extend the limits of the integral beyond the

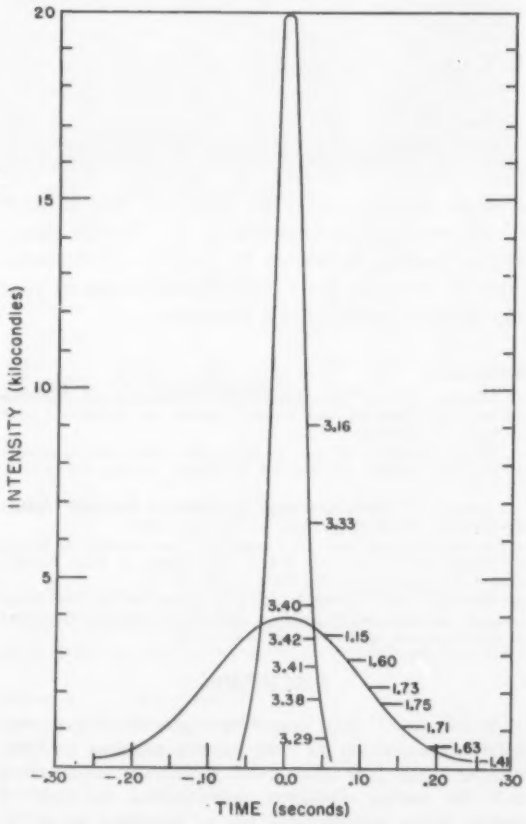


Figure 6. Examples of the effects of time limits on the computed value of effective intensity. The effective intensities are indicated at the abscissa of the time limits used in the computations.

times when the instantaneous intensity is below the threshold intensity for steady burning lights so that intensities which are below threshold, even for a steady burning light, are included, or to exclude intensities which are above threshold for steady burning lights. Using this reasoning, Blondel and Rey[4] suggested that the limits of the integral of equation (4) be the times when the instantaneous intensity is equal to the threshold intensity. As shown above, these are also the limits which make the computed visual range of the light a maximum. Therefore, the use of these limits in evaluating the performance of a lighting unit appears to be a logical choice.

The use of the maximum value of I_e as the effective intensity of a flashing light is probably not valid except when the light is at or near threshold. When the light is well above threshold, not only will the value of a in equation (4) be decreased, thus tending to increase the value of I_e, but also the limits of the integral should probably be extended to include the entire portion of the flash which is above threshold, thereby tending to decrease the value of I_e. In many cases this latter effect will be predominant. This is consistent with the decrease in effective intensity of airway beacons with increase in illuminance at the eye found by Neeland, Laufer, and Schaub.[5]

This analysis should be considered only as a mathematical treatment of equation (4). The analysis neither proves nor disproves the validity of this equation in determining the effective intensity of flashing lights nor the validity of the principle of choosing the limits of integration so that the effective intensity is a maximum.

References

1. Blondel, A., and Rey, J.: "Sur la Perception des Lumières Brèves a la Limite de Leur Portée," *Journal de Physique, 1* (5th Series), 530 (1911).

2. Toulmin-Smith, A. K., and Green, H. N.: "The Fixed Equivalent of Flashing Lights," *Illuminating Engineer*, London, *XXVI*, 305 (1933).

3. Hampton, W. M.: "The Fixed Equivalent of Flashing Lights," *Illuminating Engineer*, London, *XXVII*, 46 (1934).

4. Blondel, A., and Rey, J.: "Application aux Signaux de la Loi de Perception des Lumières Brèves a la Limite de Leur Portée," *Journal de Physique, 1* (5th Series), 643 (1911).

5. Neeland, G. K., Laufer, M. K., and Schaub, W. R.: "Measurement of the Equivalent Luminous Intensity of Rotating Beacons," *J. Optical Society of America, 28*, 280 (1938).

DISCUSSION

F. E. CARLSON:* These interesting papers should prove very helpful in evaluating the many lighting problems involving flashing lights. It is assumed that the calculations described hold for viewing conditions approximating the ideal. I wonder if the authors could tell us something about the influence of such factors as atmospheric transmission, other sources of light in the field of view, etc.

*General Electric Co., Large Lamp Dept., Cleveland, Ohio.

G. A. HORTON:* Messrs. Projector and Douglas are to be highly commended for presenting two papers on a subject which has been long neglected. The papers are particularly timely because of recent application of condenser discharge lights as aviation runway approach lights.

In the condenser light, the length of the flash may be of the order of 100 microseconds, while the peak of the flash may reach several million candlepower. Since the time required for the eye to reach its maximum response is of the order of one-tenth of a second, it is clear that the effective candlepower as seen by the eye is not the same as the measurable average candlepower developed by the flash.

However, by application of the formulas developed by the authors of these two papers to the measured data can the effective candlepower of the condenser lights be expressed.

I should like to ask the authors if visual field checks of the condenser lights have been made to substantiate the theory developed in the papers and, if so, what degree of agreement was obtained.

T. H. PROJECTOR and C. A. DOUGLAS:** It is a pleasure to acknowledge the comments of Messrs. Carlson and Horton and to reply to their questions.

Mr. Carlson raises the question of the relation between effective intensity and the conditions of observation. The term "effective intensity" is used for convenience, and implies narrowly restricted conditions, usually threshold illuminance, dark adaptation, etc. Strictly, the term should be "effective illuminance" for greater generality, thus automatically taking into account the effect of atmospheric attenuation on illuminance. The effect of other sources of light in the field of view and, in general, of the background condition, state of adaptation, etc., has not been sufficiently explored and is a fertile field for further investigation.

In reply to Mr. Horton, there have been a number of visual field checks of the applicability of the Blondel-Rey law to condenser discharge lights data in the United States and in Europe. All of the results of these checks show no significant deviations from the Blondel-Rey law. To our knowledge none of these results has as yet been published formally. Publication of the results of work at the National Bureau of Standards is expected in the future. It should be noted that these remarks apply only to the direct light from the source when the illuminance from the light is near threshold. Frequently, in a foggy or hazy atmosphere, the visual range of the glow of a flashing light will be considerably greater than the visual range of the direct light.

*Westinghouse Electric Corp., Cleveland, Ohio.
**Authors.

Committee Personnel

A listing of I.E.S. Committees — Standing, General, Task and Technical — with their personnel begins on page 18A.

INSTALLATIONS IN MILWAUKEE, WIS. — INSTALLATION A.

Lighting Wooden Shelves

LIGHTING OBJECTIVE: To illuminate knicknacks and titles on books displayed on shelves.

GENERAL INFORMATION: Shelf areas are often used to display art objects. Shelf recesses usually tend to be quite dark unless lighting is built-in. Cut-up opaque shelves such as those shown above present a special lighting problem. Shelf sizes and finishes for the examples shown are as follows:

	Installation A	Installation B (see next page)
Spacing between shelves	10½"	11"
Depth of shelves	10"	14"
Color	yellow	woodstain
Approximate reflectance	66%	25%

INSTALLATION: Figs. 2 and 3 show the custom installation of T-5 fluorescent lamps with ballasts located remotely. This is a very neat arrangement such that one is really not at all aware of the

(over)

A.I.A. File No. 31f

Figure 2. View of shelf area shown above with camera beneath to show fluorescent lamps.

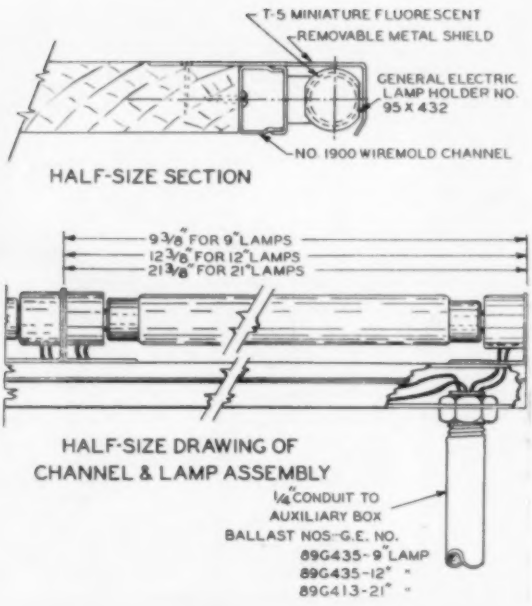

T-5 MINIATURE FLUORESCENT
REMOVABLE METAL SHIELD
GENERAL ELECTRIC LAMP HOLDER NO. 95 X 432
NO. 1900 WIREMOLD CHANNEL
HALF-SIZE SECTION
9 3/8" FOR 9" LAMPS
12 3/8" FOR 12" LAMPS
21 3/8" FOR 21" LAMPS
HALF-SIZE DRAWING OF CHANNEL & LAMP ASSEMBLY
1/4" CONDUIT TO AUXILIARY BOX
BALLAST NOS-G.E. NO.
89G435-9" LAMP
89G435-12" "
89G413-21" "

Figure 3. Detail drawing of installation of miniature fluorescent tubes at front edges of shelves.

source of the light. The front faces of the metal shields in Installation B are "grained" to match the wood and one has to actually touch them to believe they are not edges of the wooden shelves!

The resultant illumination and brightnesses are indicated below:

	Installation A	Installation B
Brightness of center of back wall between shelves	12 ft-L	7 ft-L
Vertical footcandles no books	22 ft-c	32 ft-c

(The lamps above the top shelf in Installation B are visible to people seated close by. If this installation is copied it is suggested that a slightly deeper shielding be used on the top shelf if it can be viewed at close range.)

Figure 4. Installation B. Use of same lighting technique on long unbroken shelves.

Lighting data submitted by Charles N. Laupp, Wisconsin Electric Co., Milwaukee, Wis., as one solution to a lighting problem and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

12-57

Among the numerous duties specified for the General Secretary in the Constitution is the requirement that he prepare annually a report for publication in the designated official publication, ILLUMINATING ENGINEERING. This report, based on material recorded from the Officers, Committees, and Sections and Chapters, has been assembled with the assistance of the staff at headquarters. A preview of certain phases of this report was presented at the opening session of the National Technical Conference in Atlanta, on September 9, 1957.

The General Secretary Reports

By RICHARD G. SLAUER

Membership

Statistics — Table I of this report shows the present membership of the Society compared with figures at the conclusion of each of the past five fiscal years. These figures continue to show a growth in the major membership classifications. The growth of the Society's membership since 1906 is shown graphically in the curves of Fig. 1.

Table II of this report records the gains and losses for the year and the general accounting of changes in all grades of membership. The over-all net increase of 246 brings the total membership of the Society to 8,726.

Table III records the Society membership by Sections and Chapters divided according to grade of membership.

Members Emeritus, Fellows — The Constitution of the Society specifies three grades of membership designed to recognize Members who have made contributions to the activities of the Society and to the general field of illuminating engineering. This year action was taken by Council naming as Members Emeritus four who performed for the Society services of such meritorious character as Council deemed worthy of this honorable reward. They are:

C. A. Atherton, New England Section
Leo Dolkart, Chicago Section
Milton B. Hastings, Toronto Section
William F. Little, New York Section

Based on their valuable contributions to the technical activities of the Society and to the science or art of illumination, ten Members of the Society were recommended by the Board of Fellows and were approved by Council. They are:

George A. Freeman	James H. McCulloch
J. Samuel Hamel	Alston Rodgers
Charles W. Jerome	Dana W. Rowten
J. Roy Jones	Theodore H. Shepherd
W. Wallace Lozier	Ray P. Teele

Deceased — The Society records with sorrow the death of two Members Emeritus, 2 Fellows, 18 Members and 29 Associate Members during the fiscal year.

Members Emeritus

Evans, A. D.	Lansingh, V.

Fellows

Lowry, Erwin F.	Wyatt, F. D.

Members

Addison, S.	Manchester, Paul
Beck, M. B.	Manwaring, A. Homer
Colville, J. R.	Matthews, William C.
Crounse, Harold Y.	Mock, W. R., Jr.
DeLaRosa, Juan C.	Romberger, C. E.
Freund, Mortimer	Shuck, Gordon R.
Gleeson, T. P.	Test, Russell L.
Hanscom, William W.	White, Wilfred F.
Lloyd, Robert E.	Wilson, Robert W.

Associate Members

Albrecht, Henry	Holland, John
Anderson, H. V.	McCall, D. A., Jr.
Bentley, W. J.	Munding, W. A.
Berinstein, Jules C.	Nielsen, Borge
Brown, Byron B.	Orzech, Joseph P.
Buchter, Jacob	Preston, Duncan
Callander, Jack O.	Rupp, Charles
Clark, A. L.	Stephenson, George J.
Cole, John M.	Streich, H. C.
Dahlin, B. A.	Tracht, Robert R.
D'Arcy, James, Jr.	Venell, Dwight R.
Dorrans, W. J.	Voss, Lawrence
Flaharty, E. Way	Wagner, J. F.
Gilpin, Earle D.	Wanty, Arthur A.
	Yunker, C. A.

TABLE I — Membership as of September 30.

	1952	1953	1954	1955	1956	1957
Members Emeritus	34*	32*	34*	35*	37*	40*
Fellows	41	70	78	89	99	106
Members	1,797	1,870	1,939	1,979	2,123	2,212
Associate Members	5,293	5,579	5,621	5,887	6,036	6,211
Student Members	229	244	230	188	185	157
Total	7,394	7,795	7,902	8,178	8,480	8,726
Fellows of the Society included	11*	12*	12*	12*	10*	11*

TABLE II — Gains and Losses in Membership During Year Ending September 30, 1957.

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
October 1, 1956	37	99	2,123	6,036	185	8,480
Gains						
Elections	1 (Honorary)		120	1,007	68	1,196
Reinstatements			24	86	1	111
Transfers	4	10	109	15		138
Total Gains	5	10	253	1,108	69	1,445
Losses						
Resignations			87	428	19	534
Dropped			41	367	68	476
Deceased	2	2	18	29		51
Transfers		1	18	109	10	138
Total Losses	2	3	164	933	97	1,199
Net Change	3	7	89	175	−28	246
Total Membership as of September 30, 1957	40*	106	2,212	6,211	157	8,726

*Includes 11 Fellows.

A Transaction of the Illuminating Engineering Society.

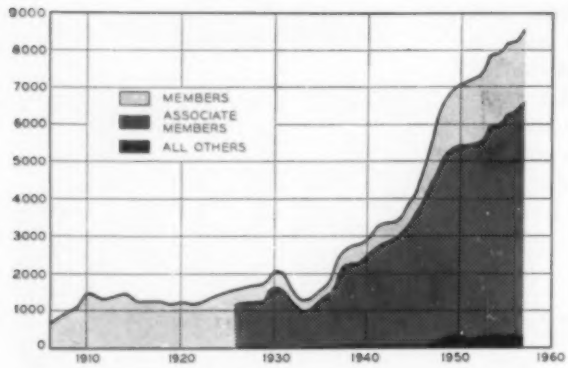


Figure 1. Membership: Total, Members, Associate Members, all others.

Figure 2. Growth of Sections and Chapters.

Regional Activities

Committee Program — With George J. Taylor, Vice-President, the eleven Regional Vice-Presidents in the Regional Activities Committee carried on an active program in the service of Sections and Chapters. During this year the two new Regions, Southeastern and South Central, functioned under their respective Vice-Presidents, embracing together the Sections and Chapters which previously made up the Southern Region. The agenda of the five full-day meetings of the Committee included a wide range of subjects and at one meeting a half day was devoted to the seminar discussion of "The Effective Operation of Sections and Chapters."

Following the practice of last year's Committee a number of study projects were undertaken by task subcomittees. Of the twelve such projects, eight were completed during the year, as follows:

1 — Planned Chapter Development — This report was referred to Council which accepted it and referred it to the incoming administration.

2 — Meetings of Regional Activities Committee — This resulted in the recommendation that the Committee continue its present pattern of meetings.

3 — President in Regional Conference Program — This resulted in a review of the President's participation in Regional Conference Programs.

4 — Presidential Attendance at Regional Conferences — This resulted in agreement that the President should continue his attendance at Regional Conferences.

5 — Regional Conference Technical Programs — This report assembled answers sent in by Chairmen of Regional Conferences during the past two years.

7 — Travel Funds for Regional Vice-Presidents — This report recommended that funds be made available to the Regional Vice-Presidents in proportions determined by the ratio of the circle tour of Sections and Chapters in each Region to the total for all Regions.

8 — Local Solicitation of Funds — This report expressed the Society's concern over the solicitation of funds from Sustaining Members, for special activities.

9 — Organizing Material for Effective Reference of Regional Vice-Presidents — This report resulted in the request that the Executive Secretary maintain a file and cumulative index of all Committee Study Projects.

Section and Chapter Programs — The 77 Sections and Chapters of the Society all carried out programs of service through organization of their local memberships and committees. According to reports received at headquarters, over 600 regular and special meetings were held during the year, mostly on a monthly basis, with an attendance of members and guests of over 30,000. The scheduling of speakers and subjects for these meetings provides the largest opportunity for direct participation by the membership in the Society program.

A number of the local groups operated as a regular part of their local program, a study club or technical forum, offering the more detailed discussion of the technical aspects of illuminating engineering.

Residence Lighting Forums continue to be an important activity of nine of the Society's Sections: Arizona, Georgia, Michigan, New York, North Texas, St. Louis, Tennessee Valley, Twin City and Utah. Regular monthly meetings were scheduled by most of the Forums, with discussions and demonstrations

New Chapters Established During 1956-57.

No.	Chartered by Council	Name	Headquarters City	Region
76	April 17, 1957	St. Maurice Valley	Trois Rivieres, Que.	Canadian
77	June 12, 1957	Coastal Empire	Savannah, Ga.	Southeastern

Chapters Elevated to Section Status During 1956-57.

Approved by Council	Name	Headquarters City	Region
Dec. 13, 1956	Cornhusker	Omaha	Midwestern
Feb. 14, 1957	Alamo	San Antonio	Southwestern
April 17, 1957	Southeast Florida	Miami	Southeastern
April 17, 1957	Miami Valley	Dayton	Great Lakes
April 17, 1957	Ottawa	Ottawa	Canadian
April 17, 1957	San Diego	San Diego	South Pacific Coast
May 8, 1957	Virginia	Richmond	East Central
June 12, 1957	Palmetto	Greenville	Southeastern

conducted by their own members and prominent men and women of the lighting industry and allied fields.

Operating under the revised Guide prepared by the Lighting Service Committee 61 of the Sections and Chapters scheduled "Most Interesting Lighting Job" Contests. Winners in the local contests, which provided unusually fine local programs, went into the Regional Conference competitions.

Local Representatives — With the cooperation of the Regional Vice-Presidents, the Sections and Chapters again recommended the appointment of local representatives to carry on the work of the Society in areas not served directly by the local programs of Sections and Chapters.

Student Branches—During the year, four of the Society's Student Branches continued active and four were inactive. No new Branches were formed during the year. Regular meetings and programs were operated by the Student Branches at:

Oregon State College
Southern College of Optometry
University of Illinois
University of Miami

Regional Conferences—Considerable effort again went into the planning of Regional Conferences. Preliminary schedules for two years in advance were developed to assist local committees in their planning of organization, hotel facilities and programs. Such advance planning again resulted in a full schedule of nine Regional Conferences in all except the Southeastern and South Central Regions, which are host to the National Conference. The summary of 1957 Conferences, with principal local officers, follows:

Canadian—May 16, 17—Sheraton Brock Hotel, Niagara Falls. Chairman — John H. Mills, Chadwick-Carroll Brass and Fixtures Ltd.
East Central — May 23, 24 — William Penn Hotel, Pittsburgh. Chairman — James A. Hodges.
Great Lakes — May 13, 14 — Pantlind Hotel, Grand Rapids. Chairman — Arthur Slenker, Consumers Power Co.
Inter-Mountain — April 11, 12 — Alvarado Hotel, Albuquerque. Chairman — Stanley Bazant; Vice-Chairman — Carl R. Albach.
Midwestern — May 9, 10 — Astor Hotel, Milwaukee. Chairman — Beverly Bunn.
Northeastern — June 13, 14 — Statler Hotel, New York. Chairman — Sam Hazelton, General Electric Co.
Pacific Northwest — March 28, 29 — Empress Hotel, Victoria. Chairman — Gordon J. Roper, British Columbia Electric Co., Ltd.
South Pacific Coast — April 3-5 — Statler Hotel, Los Angeles. Chairman—William Shalda.
Southwestern — April 28-30 — Holiday Inn Hotel, Oklahoma City. Co-Chairmen — Dale Hampton, Oklahoma Gas & Electric Co.; W. S. Irving, General Electric Co.

TABLE III — Membership of Sections and Chapters as of September 30, 1957

	Members Emeritus	Fellows	Members	Associate Members	Student Members	Total
CANADIAN REGION						
Bluenose Chapter			13	24		37
Hamilton, Ontario Chapter			7	27		34
Maritime Chapter			6	42		48
Montreal Section			33	85		118
Ottawa Section			12	47		59
Quebec Chapter			7	21		28
St. Maurice Valley Chapter			6	18	1	24
Toronto Section	1	4	53	164	1	223
Winnipeg Chapter			4	36		40
EAST CENTRAL REGION						
Capital Section		7	38	59		104
Eastern Pennsylvania Section	1		39	119		159
Maryland Section		1	22	58		81
Philadelphia Section (1)	1	4	83	202		290
Pittsburgh Section		1	62	132	2	197
Virginia Section	1		24	35		60
GREAT LAKES						
Central New York Section		3	33	88	2	126
Cleveland Section (2)	6	28	104	232	2	372
Miami Valley Section		1	14	44	3	62
Michigan Section	2	3	71	195	3	274
Northwestern Ohio Section			24	44		68
Ohio Valley Section			28	55	1	84
Rochester Section		1	15	87		103
Western Michigan Section			19	61		80
Western New York Section			9	84	1	94
INTER-MOUNTAIN						
Arizona Section			26	73	1	100
New Mexico Chapter			6	32	2	40
Rocky Mountain Section		1	17	53		71
Southern Colorado Chapter		1	8	14		23
Utah Section			22	41		63
MIDWESTERN						
Central Illinois Chapter			11	38		49
Chicago Section (3)	6	5	121	339	15	486
Cornhusker Section			18	71	2	91
Heart of America Section			31	89		120
Indiana Section			27	71	3	101
Iowa Section			22	63		85
Milwaukee Section		2	37	162	6	207
St. Louis Section		2	37	155	1	195
Twin City Section			30	170		200
Twin Ports Chapter			6	28		34
NORTHEASTERN						
Connecticut Section (1)	3	2	39	125		169
Eastern New York Section (1)	4	1	16	61		82
New England Section	3	7	88	224	3	325
New York Section (1)	2	15	195	351	9	572
Yankee Chapter			15	35		50
PACIFIC NORTHWEST						
British Columbia Section			20	58		78
Chinook Chapter			7	25		32
Edmonton Chapter			11	63		74
Inand Empire Chapter			12	43		55
Oregon Section	1		32	66	10	109
Puget Sound Section			28	76	1	105
Vancouver Island Chapter			4	21		25
SOUTH CENTRAL						
Alabama Section			23	56		79
Arkansas Chapter			4	20		24
Mid-South Chapter			9	22	55	86
Mississippi Chapter			6	26	1	33
New Orleans Section			22	67		89
Tennessee Valley Section			20	47		67
SOUTHEASTERN						
Coastal Empire Chapter			21	82	2	107
Florida Section (1)	2		60	87		147
Georgia Section			22	66		89
Palmetto Section		1	13	51	4	68
Southeast Florida Section			14	29		43
Suwanee River Chapter			33	83	3	120
Tar Heel Section		1	7	19	1	27
SOUTH PACIFIC COAST						
Golden Gate Section	1	2	61	218	2	284
Mother Lode Chapter			13	20		33
San Diego Section	2	1	21	36		60
San Jose Chapter		1	9	18	1	29
Southern California Section (1)	2	5	84	245	7	343
SOUTHWESTERN						
Alamo Section		2	14	49	1	66
Ark-La-Tex Chapter			11	30		41
Central Oklahoma Chapter			6	34	2	42
North Texas Section		2	32	108	2	144
Oil Capital Section			19	32	2	53
Panhandle Chapter			8	27		35
San Jacinto Section			17	40	1	58
Foreign Non-Section	2	2	47	158	3	212
Mexico Chapter			4	35	2	41
TOTAL (11)	40	106	2212	6211	157	8726

Numbers in parentheses indicate Members Emeritus who are Fellows.

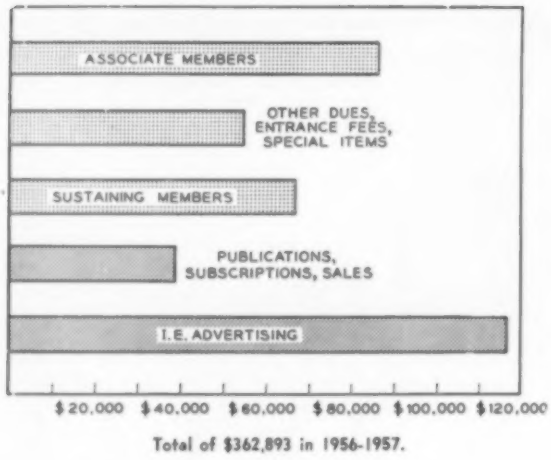


Figure 3. The Society's Financial Support.

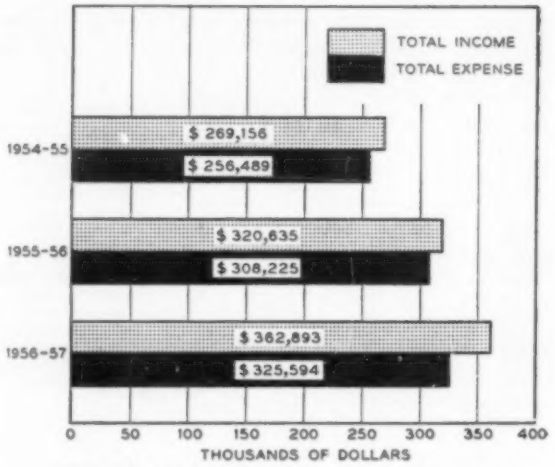


Figure 4. Comparison of Income and Expense.

Finance

The Committee, with W. P. Lowell, Jr., Chairman, continued its direct supervision of the financial affairs of the Society, as charged in the articles of the Constitution.

The Committee's work included, as usual, the preparation of an operating budget and its presentation for Council adoption at the September meeting. This included a careful review of the requests from all Sections and Chapters for budget allotments for the year.

During its first meetings in the year the Committee reviewed the Society's investment portfolio and reported to Council that further investments in the reserve should be diversified into securities other than government bonds and utility preferred stocks. The resulting recommendations approved by Council, led to the investment of some of the reserve funds in the stock of an Investment Trust and in a fire insurance company common stock.

The Committee also reviewed and recommended for Council approval the financial reports for the 1956 National Technical Conference and the proposed budget for the 1957 National Technical Conference. Incident to the planning of the 3rd Edition of the *I.E.S. Lighting Handbook*, the Committee reviewed the special budget for this activity and recommended its approval to Council.

The Committee reviewed the Society's banking operations and from this recommended the revision of a number of procedures in the handling of funds, the signing of checks and the maintaining of bank accounts. These were referred by Council to the appropriate officers and committees for further study and action.

The Annual Report on the Society's financial condition was presented to Council at the February meeting in conjunction with the Treasurer's Annual Report.

Fiscal Year Statements—The official financial statements for the year are

Statement of Income and Expense for the Year Ending September 30, 1957

INCOME

Annual Dues		
Fellows	$ 1,800.00	
Members	38,061.25	
Associate Members	86,377.24	
Student Members	683.41	
Entrance Fees	2,822.50	$129,744.40
Sustaining Members		66,402.46
Sales, Publications, Gross		
IES Lighting Handbook, 2nd Edition	8,258.26	
Lighting Data Sheets	2,535.09	
Reprints	10,899.24	
ILLUMINATING ENGINEERING	15,629.89	
National Technical Conference Preprints (1957)	1,378.59	38,701.07
ILLUMINATING ENGINEERING, Advertising		116,784.04
Sales, Badges and Certificates, Gross		852.00
Investments		4,908.38
1957 National Technical Conference Income	16,354.50	
Less: Expense	14,812.21	1,542.29
Miscellaneous		3,958.52
TOTAL INCOME		$362,893.16

EXPENSE

General		$ 6,775.72
Office, Business	$ 58,979.78	
Office, Technical	45,388.01	
Office, Publications	49,563.87	153,931.66
Organization, Committees	7,627.40	
Sections and Chapters	28,050.21	
Regional Vice Pres. Travel	3,000.00	
President's Travel	4,000.00	42,677.61
Sales, Badges and Certificates		673.24
Depreciation, Publications Stock		300.44
ILLUMINATING ENGINEERING to Membership		63,533.69
Sales, Publications, Cost of Stock		
IES Lighting Handbook, 2nd Edition	2,266.25	
Lighting Data Sheets	716.51	
Reprints	5,587.86	
ILLUMINATING ENGINEERING	8,456.24	
National Technical Conference Preprints (1957)	1,436.58	18,463.44
Sales, Publications, Stock, Services, Sales and Advertising Promotion		12,544.65
Retirement Pension Plan		4,513.25
Federal Social Security Tax		1,681.11
To I.E.S. Research Fund		20,500.00
TOTAL EXPENSE		$325,594.81
NET INCOME		$ 37,298.35

Balance Sheet as of September 30, 1957

ASSETS

Cash in Banks		$ 90,122.33
Petty Cash Fund		300.00
Accounts Receivable		7,689.83
Investments (Cost)	$ 97,056.51	
Accrued Increments, U. S. Savings Bonds	2,075.00	99,131.51
Inventories, Publications		8,279.14
Furniture and Fixtures		1.00
Deferred Charges to Expense of 1956-57		
Sections and Chapters	4,204.69	
ILLUMINATING ENGINEERING	13,526.82	
General Office Expense	1,969.50	19,701.01
Accrued Interest on Investments		161.25
TOTAL ASSETS		$225,386.07

LIABILITIES AND SURPLUS

Liabilities		
Accounts Payable		$ 2,001.70
Deferred Income		
Dues Received in Advance	$ 1,965.29	
Subscriptions Received in Advance	5,411.10	7,376.39
Surplus		$216,007.98
TOTAL LIABILITIES AND SURPLUS		$225,386.07

provided as part of the auditor's report including the income, expense statement, and the balance sheet. The figures from these statements have been converted to the usual chart form to show the Society's Financial Support (Fig. 3), the Cost of Society Services (Fig. 5), and the Comparison of Income and Expense for the last three years (Fig. 4).

Procedures and Policies

The Committee, with G. W. Beals, Chairman, conducted its affairs by one formal meeting, several conferences between members, and considerable correspondence. Its major assignments were three very controversial subjects carried over from the previous year.

Concluding a study which has been carried on for several years a policy statement was accepted by Council at the December meeting regarding Publication of Transactions, and approved for inclusion in the Manual of Procedures and Policies, as follows:

I.E.S. Procedure — In recognition of problems of publication in connection with National Technical Conference papers and discussion, it shall be standard procedure to afford the Publications Committee an opportunity to review and submit comment regarding publication of such material before final approval for publication. In its preparation of such Transaction material for publiction, the Papers Committee shall give the Publications Committee opportunity to review and comment before such material is approved or re-submitted to the author or discusser for approval, if revised.

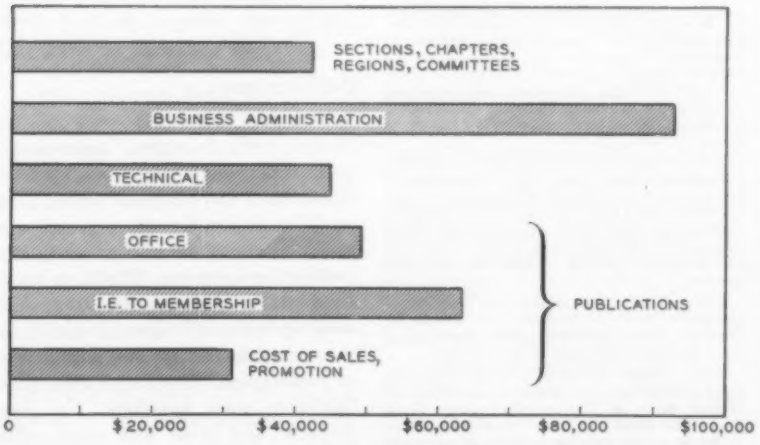
I.E.S. Policy — It shall be the Policy of the Society to publish in ILLUMINATING ENGINEERING the technical work of the Society known as the Transactions. Transactions shall be definitely identified as such and published in full as approved by Council or as constitutionally prescribed. In special cases where the proposed publication of a National Technical Conference paper and/or discussion constitutes a problem for the author, or the Papers anl Publications Committees, and the problem cannot be resolved between the Committees or author and Papers Committee, the problem shall be referred to Council or Executive Committee for final solution, prior to approval of the Transaction for publication.

"Transactions" are defined to include the following:

1. Any Recommended Practice of the Society.
2. Any Technical Committee Report which has been approved by Council for publication.
3. Any paper accepted for presentation at the National Technical Conference when approved for publication by Papers Committee.
4. The General Secretary's Report.
5. Any actions of Council affecting the procedure and policy of the Society and designated for publication.

The subject of "Voting Privileges of Sustaining Members" was a study of means for stimulating the Sustaining Membership activity by granting voting privileges that are now specifically withheld by the Constitution. The discussion at the February Meeting of a policy statement prepared by the Committee, revealed such diverging opinion that Council withdrew the assignment.

The subject of Trophy Awards for winners of contests sponsored by National, Regional, Section and Chapter organizations of the Society was quite controversial within the Committee and Council. Recommended policy statements submitted at the April and at the June meetings of Council are being held for further study and review by Council at a later date.



Total of $325,594 in 1956-1957.

Figure 5. Cost of the Society's Services.

Management

In accordance with its constitutional responsibility the Council managed the affairs of the Society, through actions at its five meetings, and through the meetings and actions of its Executive Committee. As a step toward the more efficient use of time and travel, the first Council meeting of the year was held in conjunction with the National Technical Conference in Boston thus saving a trip for Council members to New York, in October. To provide more

time for policy discussions at Council meetings, a number of more routine matters were circulated to Council by mail, for consideration and action.

At each of its five meetings Council received regular reports from the principal Standing and General Committees, as well as progress reports on the Technical Committee program presented by the Technical Director. Several meetings of the Council and Executive Committee considered at length the progress reports of the Committee drafting revisions in the Society's Constitution. Considerable time was also given to discussion of several important reports produced by the Committee on Procedure and Policies, one of these leading to a long debated re-statement on the definition and publication of the Society's Transactions. The work of several of the Technical Committees was discussed at length during the year, these including the Handbook Revision Committee, the School Lighting Committee and the Committee on Standards of Quality and Quantity for Interior Illumination.

Official action was taken by Council in connection with the following reports of Technical Committees during the year.

Nomenclature Committee
- Additional Nomenclature Segments

Industrial Lighting — Subcommittees
- Lighting for Sawmills; Redwood Green Chain
- Lighting of Indoor Locations of Central Station Properties
- Lighting for the Color Appraisal of Reflection Type Materials in Graphic Arts

Street & Highway Lighting Committee
- Lighting of Tunnels and Underpasses

Testing Procedures Committee
- I.E.S. Guide for Photometric Testing of Searchlights
- I.E.S. Guide for Photometric Measurements of Fluorescent Lamps
- I.E.S. Guide for Photometric Testing of Outdoor Fluorescent Luminaires

Daylighting Committee
- Proposed Guide for Measuring and Reporting Daylight Illumination

Committee on Standards of Quality & Quantity of Interior Illumination
- Avoidance of Discomfort Glare in the Design of Lighting Installations

Illuminating Engineering Research Institute

During the past fiscal year the Society continued its relationship with the trustees of the Illuminating Engineering Research Institute under the provision of the Trust Agreement. In accordance with these provisions, Council approved a list of candidates considered qualified for election as trustees and also candidates for election to membership on the Research Executive Committee, to fill vacancies caused by expiring terms of office. From these nominations the Board of Trustees took action for the following personnel to serve the two groups:

Board of Trustees
A. F. Wakefield, *Chairman*
Franklin M. Foote, *Treasurer*

Conrad Berens, M.D. — Willard E. Henges
R. F. Hartenstein — O. R. Doerr
M. N. Waterman
C. L. Crouch, *Secretary*

Research Executive Committee
E. M. Strong, *Chairman*

R. M. Zabel — Glenn A. Fry
H. F. Davidson — Leonard Mead

With the presentation of the annual report of the trustees to Council, Professor Strong outlined the progress on current projects, and work has continued since on the following:

#23-B — "Muscle Action Potentials as a Measure of Visual Performance Costs," Dr. Leonard Mead, Tufts University.

#30B-C-D-E — "Further Studies of Contrast Thresholds," Dr. H. R. Blackwell, University of Michigan. The results of these studies (#30B-C-D-E) will give us a new basis for footcandle recommendations. It is anticipated that these data will be available early in 1958.

#47A & B — "Methods of Improving Visibility in Fog on Toll Roads," Prof. Charles R. Marsh, Pennsylvania State University, and Dr. H. R. Blackwell, University of Michigan. This two-phase research was undertaken at the request of turnpike authorities from ten states in an effort to reduce fatal and near-fatal accidents on the national highways. Results show that changing the mounting angles of highway lighting, using low-mounted white fog lights, and polarizing the light sources can successfully accomplish a major improvement in visibility in fog. These were demonstrated at Penn State University before an audience of turnpike authorities, highway safety experts, lighting engineers, and personnel of the Research Institute, as well as representatives from the Society. Conclusions to date have been based on observations, and further study needs to be made toward quantifying the results.

#49 — "Hot Spots in Luminaires," Dr. Glenn A. Fry, Ohio State University. This study involves determining the relative glare effectiveness of "hot spots in luminaires," and it is anticipated that results will be available this year.

#51 — "Discomfort Glare at Low Adaptation Levels — Multiple Sources," Profs. R. C. Putnam and Keith D. Bower, Case Institute of Technology. This research, to determine the effect of multiple sources in the field of view, has been completed and results presented in a paper at the National Technical Conference; publication in ILLUMINATING ENGINEERING to follow.

#52 — "Loss of Contrast Due to Specular Reflection," Prof. D. M. Finch, University of California. There are appreciable losses in contrast due to the specular reflections from paper surfaces and from ink and pencil tasks. Microphotometric readings are now being made and we anticipate results within the next six months.

#55 — "Basic Information on Visibility of Outdoor Advertising Displays," Dr. Joseph W. Wulfeck, Tufts University. This research has been completed and data made available.

#57 — "Study of Disability Glare from Automotive Headlights in Relation to Width of Median Strip on Expressways," Isaac Goodbar. This study has been completed and resulted in curves showing disability glare in proportion to the width of the median strip. This veiling glare was then translated in terms of relative visibility as affected by median width.

Nine new proposals have been submitted to the Institute this year and are being processed through the regular channels as required by the Trust Agreement.

Also, contacts have been made between the Institute and the Deputy Commissioner for Research and his associates at the U. S. Bureau of Public Roads, who are active in the President's Highway Program. These officers expressed hearty interest in having a research program to answer many design problems involved in the design of limited access highways. Several meetings have been held and a research program is evolving.

As a mark of coming of age the Institute held a Research Symposium at Cornell University where the work being carried on and the results to date were presented to the public. Over 100 engineers, professors, psychologists and physiologists attended with hearty comments of approbation and enthusiasm. Guest speaker was Dr. R. G. Hopkinson of the Department of Scientific and Industrial Research, Building Research Station in England. His presentation is published in the May and June issues of ILLUMINATING ENGINEERING and titled "Great Britain and Continental Europe — Research on Visual Comfort," and "Evaluation of Glare."

Other formal reports of the Institute which were published this last year in ILLUMINATING ENGINEERING are as follows:

"Verification of the Interflection Tables" by Russell D. Churchill and Russell C. Putnam (Project #35)
"Interflections in a Room with Luminous Walls," by H. A. Bull (Project #4)
"Some Factors Influencing the Night Visibility of Roadway Obstacles," by D. M. Finch (Project #37)

Publications

With J. S. Schuchert continuing as Chairman the Committee again developed a national organization. All of the Sections and Chapters had at least one, and some two or three people, engaged in the work of furthering the publications program. The three principal local efforts were directed toward securing editorial material and data sheets, and in the sale and distribution of publications. Regional Publications Chairmen were appointed for most Regions, and those who were active stimulated the work of Chapter and Section Publications Representatives.

Page Content of ILLUMINATING ENGINEERING
October 1956 — September 1957

	Number of Pages Published
Conference Papers, Abstracts and Discussion	287
Technical Committee Reports	98
General Secretary's Report	16
Other Technical Papers	104
Application Articles	102
Data Sheets	43
Lighting News	137
Editorials	11
Committee Personnel, Officers, Sustaining Members	33
Advertising	481
TOTAL	1302

The local and regional representatives worked closely with the appropriate national publications subcommittees and had the full cooperation of Ruby Redford, Editor, and of Clayton E. Ellis, Advertising and Sales Promotion Manager.

ILLUMINATING ENGINEERING, the Journal of the Society continued to advance on every front — as an educational medium for the dissemination of knowledge, as a publication which constantly becomes more interesting and more informative, and as a means of financial support to the Society. The subcommittee with Dr. R. M. Zabel as Chairman continued its efforts toward the procurement of editorial material for the Journal. The subcommittee on Editorial Content Review, with Hedley Davidson as Chairman continued to serve this function as called upon.

A significant achievement was recorded when the Society was notified that ILLUMINATING ENGINEERING had won an award of Merit in the class, Institutional and Professional Papers, in the 19th Annual Business Paper Editorial Achievement Competition, conducted by *Industrial Marketing*.

I.E.S. Lighting Data Sheets — Dr. R. M. Zabel, Chairman; Eve Freyer, Chairman, Residential Data Sheets. During the year the increased quantity and improved quality of Data Sheets continued to offer illustrations of installations which comply with I.E.S. Standards and Recommended Practices. This is an important part of the work of the Society and of the dissemination responsibility of its publications.

Research Brochure — R. W. Morris, Chairman. Work continued on the planning and preparation of a research brochure which will be helpful in explaining the Research Program and obtaining financial support.

Sales and Distribution, Reprints, Reports, Recommended Practices — Brooks Chassaing, Chairman. The material available for distribution has been very limited in quantity. However, the following results have been achieved:

(1) Society Publication Representatives all over the country understand the Society's dissemination responsibilities and objectives.
(2) Efforts constantly have been put forth (and some have been quite successful) to distribute widely such limited material as has been available.
(3) The organization which has been developed (with improvements and changes gained from experience) will be in a position to perform the dissemination, distribution and sales job as effectively as possible as more and more material becomes available.

Advertising. The past year marked a further gain in the acceptance, appreciation and understanding of the value of ILLUMINATING ENGINEERING as an advertising medium. This resulted in a financial report which, for the year, shows that The Journal was produced without cost to the Society and, in fact, produced revenues appreciably in excess of expenditures.

Changes and Improvements in Publications — R. W. Morris, Chairman. This subcommittee has been assigned the continuous responsibility of giving constant consideration to changes and improvements in all the Society's publications. Constructive critical analysis is made of the format, cover, style, etc.

Standing Committees

Seven Standing Committees are set up by Constitutional provision and reference has been made earlier in this report to the work of three of these— Council Executive, Finance and Publications. Reports for the remaining four follow.

Board of Fellows

Ralph M. Evans, Chairman

The Board met in April to consider nominations for transfer to Grade of Fellow. Prior to the meeting each member was provided with information regarding all candidates, so that the members of the Board had opportunity to study the candidate qualifications before the meeting.

Ten nominations for the Grade of Fellow were approved and recommended to Council for action at its June meeting, along with suggested citations briefly describing the contributions of the nominees.

Papers

H. F. Davidson, Chairman

As in the past, the work of the Committee has been largely the solicitation and selection of technical papers for the Annual Technical Conference. This Committee also acted in an advisory capacity for the review of several technical articles prior to publication in ILLUMINATING ENGINEERING.

For the 1957 Conference 34 papers were selected for Conference presentation out of almost double this number of outlines submitted. Unfortunately five papers did not make the conference program because of lateness or being below the required technical standard.

A special session of general interest to all members was the session on lighting for T.V. Production. This meeting was under the direction of Walter H. O'Meara, Chairman of the Committee on Lighting for T.V. Production.

Due to the increasing fields of interest of the Society membership it is becoming necessary to increase the number of technical papers and sessions at the annual Conference. This requires an increase in the number of parallel sessions especially when only five of the eight half days of the conference are available to the Committee for scheduling technical papers.

General Board of Examiners

S. W. Braun, Chairman

During the past year applications for higher membership ranks processed by the Board about equalled the number processed in the previous year. A total of 253 were recommended to Council for favorable action. In addition, four Member Emeritus elections were recommended for Members proposed for this honor by their respective Sections.

Medal Award

Berlon C. Cooper, Chairman

In accordance with approved proce-

dure, the committee held a first and a second meeting in New York City in January and in April. The qualifications of all nominees for the medal were given most careful consideration. It was the unanimous recommendation of the committee to the Council that, because of his outstanding contributions in illuminating engineering education and research, Prof. John O. Kraehenbuehl be designated as recipient of the 1957 Gold Medal.

General Committees

The General Committees of the Society are charged with the operating functions not handled by the Standing Committees, and not pertaining to the preparation of reports on scientific and engineering subjects. The work of two of these has been given in the preliminary part of this report — Procedures and Policies and Regional Activities. Reports for the balance of the General Committees follow.

Advance Planning

F. C. Winkler, Chairman

The recommendations included in the 1956 report of this Committee were considered by Council during 1956-1957, with official record in the minutes of the February 1957 meeting. The report of the Committee submitted prior to the June Council meeting was received by Council and scheduled for discussion and action at the first Council meeting in the 1957-1958 administration.

Advisory Board to the President

Kirk M. Reid, Chairman

The Board met three times and submitted to the President and President-Elect recommendations on organization, chairmanships, and personnel of committees.

Allied Arts

Karl A. Staley, Chairman

During the year the Committee assisted five new groups to organize Allied Arts Actitvities in the form of student lighting contests. These were the *Winnipeg Chapter* — University of Manitoba; the *New England Section* — Boston Architectural School; *Georgia Section* — Georgia Institute of Technology; *New Mexico Chapter* — University of New Mexico, and the *Utah Section* — University of Utah. In addition, jointly with chapters of the American Institute of Architects in a number of cases, the following Sections conducted contests: Arizona, Cleveland, Golden Gate, New York, Ohio Valley, Philadelphia, and Southern California.

In the New York Section, interior design students were invited to compete as individuals alongside architectural students of their school (Pratt Institute). (The contest includes three schools — architect-students of Cooper Union Institute and Columbia University also compete.) The results showed that this was a positive move; the first two prizes were won by the interior design student.

At Kent State University, the Eastern Ohio Chapter of A.I.A. collaborated with the Cleveland Section to conduct a five-week program for art and architect students, in teams. Next year, engineers from Akron University are expected to make this a three-profession collaborative. The program will call for a ten-week study, including lectures and critique by professionals in the three arts.

It is expected that Clemson College and Pennsylvania State University will be conducting programs next year, assisted by the Palmetto Chapter and Pittsburgh Section, respectively.

Board of Nomination

E. M. Strong, Chairman

In accordance with the Constitutional provisions and following the procedure adopted by Council, the Board was formed with three Past-Presidents of the Society and representatives of each of the eleven Regions. The Board reviewed extensive records of candidates as submitted by the respective Regional Nominating Committees, and from these prepared a nomination ticket containing names of those deemed best suited to serve as officers and directors in the positions to be filled at the ensuing election.

Constitution and By-Laws

G. Franklin Dean, Chairman

A continuation of the work started last year on the major revision of the Constitution and By-Laws occupied the attention of the Committee throughout the year. Two Committee meetings were held. Also, a great deal of correspondence developed from the serious and lengthy consideration given to draft revisions of the Constitution by the Council Executive Committee at the meetings November 8th, and May 8th.

A draft Constitution was prepared, with the suggestions proposed by Council Executive Committee incorporated, and was submitted for Council's consideration at the June meeting.

Many of the proposed clauses were debated by Council at length, resulting in several changes in the draft being given to the Committee to be included in a final report for circulation to Council members previous to the next meeting of Council. It is expected that the proposed revision will be submitted to the membership next year.

Defense Coordinating

J. W. Bateman; A. F. Wakefield, Co-Chairmen

Work on the incomplete parts of the 16 projects has continued during the year. No new solicitation of Defense agencies has been made by the Committee during the current year.

The 16 projects listed in previous annual reports proved the acceptance of the plan by Defense agencies and placed the Society on record as willing and able to cooperate with the Defense agencies for the public good.

Project #2 — "Artificial Moonlight" for battlefield illumination, was subsequently assigned to the University of Michigan for general warfare purposes, instead of infantry movements as first contemplated in the proposal which the Committee organized.

Historical

S. G. Hibben, Chairman

The current program of the Committee includes the following projects:

Enlarging Headquarters Library.
Fixing up certain historical exhibits, photos, drawings, etc., in the Headquarters Boardroom.
Establishing the official emblem, or badge.
Editing the material on the 50-year history of luminaire development (this being gathered over the past three years) for ultimate book form.
Biographies of famous lighting persons (three done).
Disc record library of Past-Presidents (three done).
Collections of memorabilia, particularly as famous persons die, or estates are settled.
Lists of historical lighting devices, and of various owners, or of museum displays.
Plaques, or markers, of historic lighting spots.
Aids to theses or story writers, authors, etc.

During the year the Committee developed close liaison with the newly organized Electrical Historical Foundation, the Chairman serving in this group of Trustees, as Secretary.

Lighting Service

Lee E. Tayler, Chairman

The Committee took inventory of its major project, the "My Most Interesting Lighting Job" contest, for the purpose of determining sustained interest. It was found that areas of little or no interest were spotty. Reports from Regional Vice-Presidents, however, indicated that there is no general decline in membership interest. It appeared evident that where active local contest chairmen were appointed, interesting and valuable entries were obtained.

To meet membership requests, the Committee expanded the contest procedure to include two classifications of entries. They were Class I — Residential Installations and Class II — Commercial, Industrial and all others. The purpose of this change was to stimulate interest in preparing residential entries. From reports it appears that this procedure has been effective and generally accepted. Reports from the Regional Contests indicated there were winners in both classes from all Regions. This being the first year of such procedure, there seemed to be some concern about single entries in the Residential classification.

Through the generosity and interest of Past-President Charles H. Goddard, a beautiful trophy was presented to the Society on a perpetual basis to be presented to the winner of the program each year. This trophy was first awarded in 1956 at the National Technical Conference in Boston.

The Lighting Service Forum held in conjunction with the National Technical Conference in Atlanta consisted of the National Contest of Regional winners. All Regions were represented, the winners receiving certificates and cash prizes at the annual banquet. The winners were also presented with the Goddard Trophy. Those winning the first, second, third and fourth places in the National Contest were:

Class I — Residential
First — Mrs. Edna Fortier, New Orleans Section, South Central Region.
Second — George Matilo, Cleveland Section, Great Lakes Region.
Third — Jack T. Cottingham, Oregon Section, Pacific Northwest Region.
Fourth — Edwin Schnoll, Milwaukee Section, Midwestern Region.
Class II — Commercial and Industrial
First — H. J. Poehling, St. Louis Section, Midwestern Region.
Second — Lawrence Genise, Michigan Section, Great Lakes Region.
Third — Earl I. Dinsmore, North Texas Section, Southwestern Region.
Fourth — Werner F. Rosacker, Eastern Pennsylvania Section, East Central Region.

Membership

Brooks Chassaing, Chairman

The Committee embarked on its 1956-1957 program with a three-point goal:

(1) An increase in new members
(2) Holding losses to a minimum
(3) An increase in the ratio of Member Grade to Associate member grade

The Committee consisted of its Chairman, a Regional Membership Representative from each of the Society's eleven Regions and five Members-at-Large. The Regional Membership Representatives were assigned specific tasks within their Region, and the Members-at-Large were asked to assist in general promotional activities on membership.

In February 1957 a special campaign to gain membership among Consulting and Electrical Engineers was conducted among the Sections and Chapters. Thirty-six Sections and Chapters participated in the campaign and from their efforts the names of more than 1000 Consulting and Electrical Engineers not previously known were received. Special letters were mailed to these engineers and a favorable response including the gain of some as members resulted.

A particularly strong effort was made in the direction of holding losses to a minimum. This program included the mailing of a special post card to each Section and Chapter Membership Committee Chairman or Vice-Chairman during the final week of October, November, December and January urging them to call to the attention of their members, at regular meetings, the importance of prompt dues payment. A comparison with losses suffered in previous years based on total membership indicates some success in this phase of the program.

Special emphasis was placed on strengthening the Society by increasing the percentage of Member Grade to the whole membership and this percentage was increased slightly during the year.

As in previous years a membership campaign was conducted among the Sections and Chapters, these being divided into four groups based on membership figures as of October 1, 1956. The campaign was divided into two parts, namely for "gains" in membership and for holding down "losses." There were monthly reports sent each month beginning in November 1956 to the Section and Chapter Membership Committee Chairmen, with copies to the Section and Chapter Chairmen and to all members of Council and members of the National Membership Committee. Those Sections and Chapters who complied with the rules governing the special February 1957 Campaign for new members among Consulting and Electrical Engineers were awarded a 2 per cent bonus on the "gain" side of the campaign for the year.

The winners in the "gain" part of the campaign were as follows:

Group I — Michigan Section
Group II — Montreal Section
Group III — Palmetto Section
Group IV — Edmonton Chapter

The winners for the "low-loss" part of the campaign were as follows:

Group I — Cleveland Section
Group II — Georgia Section
Group III — Palmetto Section
Group IV — Mexico Chapter

The Committee inaugurated this year a contest on "gains" and "low-loss" among the eleven Regions of the Society and Recognition Certificates were awarded to the Regional Vice-Presidents of the winning Regions which were:

For "gain" in membership — Pacific Northwest
For "low-loss" in membership — Southeastern

An innovation this year was the action of the Inter-Mountain Region in assigning a part of its Regional Conference program to a discussion by the Chairman of the National Membership Committee.

The total gain in new members for the year was 1246 and while short of the goal set this figure compares favorably with gains in recent years.

National Technical Conference

James C. Forbes, Chairman

Using the Long Range Planning Guide developed in 1955-56, the Committee acted upon a number of invitations from Chapters and Sections desiring to sponsor the National Technical Conference in future years. Committee members inspected the suggested hotel and other facilities in the company of local representatives. Following this review the conference locations of Pittsburgh, Pennsylvania for 1960 and St. Louis, Missouri, for 1961 were recommended to Council and were approved.

A subcommittee prepared a guide

Conference Registration Records

1953	New York, N. Y.	1,007
1954	Atlantic City, N. J.	851
1955	Cleveland, Ohio	754
1956	Boston, Mass.	961
1957	Atlanta, Ga.	926

for National Technical Conference operation which, after review by the entire Committee and following approval by Council, was published and circulated to all interested parties.

Public Relations and Information

J. R. Chambers, Chairman

Based on the planning carried out at two organization meetings held early in the year, the Committee presented a program to Council at the April meeting. This program was approved by Council and provided for the retaining of professional public relations counsel. Through this medium a considerable volume of publicity was developed via the press, radio and television broadcasts on the occasions of the Regional Conferences and the National Technical Conference at Atlanta.

Residence Lighting Forums

Ruth Morris, Chairman

One Committee meeting was held in New York in early March to plan the program for the Atlanta Conference, and to discuss ways of stimulating the formation of new Forums.

Two new Forums were established, one in Dallas, April 1957, by the North Texas Section and one at Phoenix by the Arizona Section in the Spring of 1956, the latter reported too late to be included in last year's resume.

Forum programs included Trends in Fixture Design, New Light Sources and Applications, Flexibility in Lighting, Lighting Family Activity and Recreation Rooms, Lighting for Outdoor Living.

Prominent in this year's Forum activities were: the "Lighting Residential Interiors" Course (six sessions) with a paid registration of 48 conducted by the Forum of the New York Section. New York also sponsored its sixth annual "Lighting Design Competition" for academic and vocational high school students in New York City. The Arizona Section Forum followed a program on Outdoor Lighting with an Experimental Installation project in which 43 people participated. All members of the Georgia Section Forum at Atlanta were assigned to committees in conjunction with the National Technical Conference.

The Chicago Section Forum has been inactive this year and the Forum of Tennessee Valley Section had only one meeting. Totals show nine more program meetings this year than last, with an attendance increase of 300. Four program meetings were held jointly with Sections and two with groups representing allied interests.

Name	Membership	Program Meetings Held	Attendance
Arizona	43	10	351
Georgia	101	7	526
North Texas	46	2	97
Michigan	149	4	395
New York	141	8	386
St. Louis	61	8	446
Tenn. Valley	44	1	31
Twin City	62	5	390
Utah	20	4	114
TOTALS	667	49	2,735

Sustaining Membership

Fred E. Guth, Chairman

The Committee developed its principal effort toward securing new Sustaining Members from among the Electrical Distributors, Electrical Contractors, and the Manufacturers in fields closely related to lighting. A number of the Sections were especially successful in this activity, the following accounting for a total of 38 new members.

Chicago Section, Paul F. Kauffmann, B. Lazerson, Sustaining Membership Co-Chairmen
Michigan Section, C. C. Munroe, Jr., Sustaining Membership Chairman
New York Section, Meyer H. Silverman, Sustaining Membership Chairman

The remainder of the total of 59 new and reinstated members were the result of the efforts in all the other Sections and Chapters of the Society. The final figures at the close of the year are shown below in comparison with previous years.

	Members	Dues Income
1952	335	$41,735.
1953	334	40,735.
1954	336	40,635.
1955	334	43,391.
1956	414	63,893.
1957	452	66,402.

Tellers

A. R. Chick, Chairman

In accordance with Constitutional provisions the Committee met following the close of the election ballot and counted the vote both on the National and Section offices. In this the Committee had the customary assistance of headquarters personnel both in the preparation of the forms and reports, as well as in the opening of the ballots and the making of a preliminary count. The Committee submitted a supplementary report commenting on the form and handling of the ballot, and these comments were accepted by Council for later consideration in the revision of the Society's By-Laws.

Student Branches, Task Committee

Walter Sturrock, Chairman

Following its appointment in the Spring of 1957, the Committee assembled a summary of recommendations and suggestions through correspondence. These were scheduled for discussion by the Council at its first meeting in the 1957-58 fiscal year.

(1) A general Committee on Student Branches with personnel adequate to represent the activities of other committees including Education, Membership and Regional Activities, should immediately be appointed by the President.

(2) The scope of activities of this committee would include: (a) To plan and implement a program to stimulate interest in Society activities and membership among college faculty and students; and to encouarge the formation of Student Branches and assist in their operation and programs. (b) Encourage Sections and Chapters of the Society to appoint one or more members to work with local college faculty and students in extending interest in the Society.

To implement the work of a Committee on Student Branches the following suggestions are presented:

(1) Poster material and "hand-out" printed information should be prepared for distribution to college students in an effort to stimulate their interest in illuminating engineering as a profession. Such material could also be distributed to vocational high schools and technical institutes.

(2) Immediate attention should be given through the local Section or Chapter to existing Student Branches, not only to assist in planning and conducting their programs but also in expanding their membership to all students who may have an interest, even though some may not be enrolled in an illuminating engineering course of instruction.

(3) The Committee on Education and the Committee on Sustaining Memberships should be asked for specific recommendations regarding a program to promote college courses in illuminating engineering and industry employment of graduates who have studied these courses.

Headquarters Retirement Plan, Trustees

Duncan M. Jones, Chairman

The Trustees of the Plan held their regular annual meeting at the time of the National Technical Conference in Atlanta. The customary formal record was made covering the operation of the Plan during the fiscal year just completed.

Joint Task Committee, I.E.S.-U.S.P.H.S.

J. F. Parsons, Chairman

The report of this Task Committee: "How to Make a Lighting Survey; a Vision Survey" was completed in 1952 and accepted by Council as a progress report in 1955. A questionnaire to ascertain, prior to printing, the probable demand for the complete text has been circulated by the Public Health Service. A similar questionnaire is now being circulated by the Society.

Sign Lighting, Task Committee

C. N. Laupp, Chairman

In response to the request of the Outdoor Advertising Association's request for cooperation in the study of the visibility of outdoor advertising displays, Council approved the appointment of this Task Committee. During the balance of the fiscal year the Committee began the joint studies as requested, and also undertook the revision of the related sections in the new edition of the *I.E.S. Lighting Handbook*.

Technical Committees

Aviation Lighting

L. C. Simpson, Chairman

The Committee held its Fall Technical Conference at the National Bureau of Standards and had a number of papers on approach lighting for high speed aircraft, helicopter rescue lighting, emergency heliport lighting, seadrome lighting, and instrument lighting. The Spring Conference was held at Annapolis, Md. With 91 in attendance, a number of technical papers were presented on subjects including anti-collision lights, design of cockpit lighting and psychological studies of exterior lighting of aircraft.

The meeting included an inspection of the latest lighting systems for taxiways, runways and aircraft exteriors at Andrews Field, Washington.

An intensified and continuous program is being pursued by the technical subcommittees which include: Aircraft Cabin Lighting, Aircraft Cockpit Lighting, Aircraft Exterior Lighting, Airport Runway Lighting, Airport Service Area Lighting, Airport Taxiway Lighting, Approach Lighting, Aviation (Large) Lamps, Aviation Lamps (Miniature), Bibliography, Definitions and Terms, Heliport Lighting, Papers and Seadrome Lighting.

Daylighting

H. B. Vincent, Chairman

A meeting of the Committee was held in connection with the 1956 National Technical Conference in Boston with 18 members in attendance. Reports were received from all subcommittees. A proposed text of a "Guide for Measurement and Reporting of Daylighting" was presented by the subcommittee appointed for its preparation, discussed extensively and approved subject to revisions outlined. At his request, W. J. Arner was replaced by J. W. Griffith as Chairman of the Subcommittee on Brightness Ratio Measurement.

Several subcommittees were appointed or continued as follows:

Brightness Ratio Measurement — Chairman, J. W. Griffith. A meeting of the subcommittee was held in May 1957. Reports on further surveys of available data indicated that very little information exists relating to individual performance in the presence of brightness sources of large area. A proposal for a research program has been drafted.

Coordinating Subcommittee — Chairman, R. A. Boyd. In accordance with a request from the Committee on Design Practice the subcommittee revised and brought up to date the *IES Lighting Handbook* section on daylighting prediction methods. The revision was approved by the Daylighting Committee by letter ballot in January 1957.

At the request of the Committee on Nomenclature a selection was made of ten terms relating to daylighting and definitions were prepared. These were approved by the Daylighting Committee and forwarded.

Lower Ceiling Classrooms — Chairman, H. F. Kingsbury. The studies of this subcommittee on lower ceiling classrooms were assembled in a final report which was circulated to the Daylighting Committee for letter ballot. A favorable vote was received with numerous comments. Reconciliation with comments is in process.

Measurement and Reporting on the Daylighting of Interiors — Chairman, J. W. Griffith. A detailed systematic procedure for the measurement and reporting on the daylighting of interiors was prepared by the subcommittee under the title "Guide for Measurement and Reporting Daylight Illumination." The proposed text was circulated to the Daylighting Committee in October 1956, for letter ballot. It received a favorable vote with several comments. Following revisions indicated by comments, it was forwarded for submission to Council. Publication has been approved. The activity requested of this subcommittee has been completed.

Revision of Handbook Daylighting Section — Chairman, H. F. Kingsbury. A revision of the Daylighting Section of the *IES Lighting Handbook* was prepared and submitted to the Daylighting Committee for letter ballot in May 1957. The text was approved and forwarded. As requested, this subcommittee also assisted in correlation of the Daylighting Section with the revision under preparation by the Committee on Office Lighting.

Revision of Recommended Practice of Daylighting — Chairman, R. W. McKinley. On the retirement of R. A. Miller, R. W. McKinley was appointed chairman of this subcommittee. By the end of the past year arrangements had been completed for editorial service. During the year, the editor has held meetings in small groups with members of the subcommittee and assembled available information. During February, a meeting of the subcommittee was held to discuss format and general sections whose preparation had been completed. Late in June, two additional sections were submitted for review. Completion of the revision is expected during 1957-58.

Availability of Daylight (Exterior)

— Chairman, B. F. Greene. During the year this subcommittee has revised and brought up to date tables on daylight availability for inclusion in the revision of Recommended Practice of Daylighting. A report is being prepared to include additional data which has been assembled.

Design Practice

Benjamin Scott Benson, Jr., Chairman

The major emphasis of this committee has been in revising the section of the *IES Lighting Handbook* on "Calculations."

This revision work is still in hand although considerable progress has been made to date. One revision has been studied by the Committee and the second one was scheduled to be in the hands of the Committee, by the time of the 1957 National Technical Conference.

Education

H. H. Magdsick, Chairman

A subcommittee under the chairmanship of Carl W. Zersen is proceeding actively with the development of new text and illustrative material for lighting courses sponsored by Sections and Chapters of the Society. E. Wozniak heads the task group for the Lighting Fundamentals Course. Ralph R. Lusk directs the group for the more advanced Lighting Design Course.

Handbook Revision

John J. Neidhart, Chairman

The Committee in cooperation with the Technical Director's Office are editing and arranging completed manuscripts to produce an integrated *Handbook*. Up-to-date information is being organized into a new format designed to facilitate use of the *Handbook*.

I.E.S.-A.S.H.A.E. Joint Committee

R. W. McKinley, Chairman

Following publication of Part I of the report, studies were continued on the "Thermal Aspects of the Lighting System" in anticipation of a second report (Part II) analyzing the contribution which electric lighting and daylight make toward the required heating system for a building.

As a result of the work of the Committee a technical paper in this area was developed and presented at the 1957 National Technical Conference in Atlanta.

Illumination Performance Recommendations

Benjamin S. Benson, Jr., Chairman

During the year Council approved the re-activation of this Committee and assigned as its responsibility the preparation of interpretations of the report "Avoidance of Discomfort Glare in the Design of Lighting Installations"; these interpretations to be in a form suitable for the use of the lighting application committees.

Industrial Lighting

W. H. Kahler, Chairman

The Industrial Lighting Committee in 1956 had five subcommittees, on Central Station Properties, Clothing Industry, Graphic Arts, Outdoor Productive Areas and Revision of Recommended Practice (ASA). The general Committee has closely followed the activities of the subcommittees and has handled the revision of the Industrial Lighting Section for the *Handbook*. Three Committee meetings were held including one with the Clothing Industry Subcommittee in Rochester and another with the Graphic Arts Subcommittee in Philadelphia. Each subcommittee has made progress on its assigned projects, and also has contributed *Handbook* revision material.

The Clothing Industry Subcommittee — has been making fundamental visibility studies of the seeing tasks in the manufacture of clothing, using the Cottrell contrast visibility meter. These studies will give practical application experience with this meter and will be correlated with other visual performance research work, such as the studies being made by Dr. Blackwell.

The Graphic Arts Subcommittee — has prepared a preliminary report on the entire industry and has completed a report entitled "Recommended Practice for Lighting Reflection Type Materials for Graphic Arts Visual Color Appraisal." This latter report has been prepared jointly with the Research and Engineering Council of the Graphic Arts Industry Inc. and has been approved by both organizations.

The Central Station Properties Subcommittee — completed its final report "Lighting of Indoor Locations of Central Station Properties" and this report was approved by Council.

The Subcommittee on Outdoor Productive Areas — was formed in 1955-1956 and has a good start on a very complex lighting problem. The work has been broken down into a number of study projects covering railroad yards, industrial material handling and storage yards, general construction and excavating, ship yards, outdoor aircraft, outdoor steel mill areas, and strip mining.

The Subcommittee on the Revision of the Recommended Practice — has indicated that the major changes will include a greater emphasis on quality industrial lighting, and an up-to-date revision of the tables on "Recommended Illumination Levels." The latter will be based upon the most recent Society research data on visual performance as well as current practice in American industry.

Institutions Lighting

Leonard V. James, Chairman

This Committee, which includes six subcommittees (Art Galleries and Museums under J. M. Ketch as Chairman, Auditoriums and Churches under G. E. Shoemaker, Dining Areas under C. W. Zersen, Hospitals under N. L. Griffin, Hotels under C. I. Sayles, Theatres under J. E. Rubin and four Review Group members), has been very active during the past year.

The Committee has spent considerable time on revision recommendations for the *IES Lighting Handbook*. The Lighting in Theatres Subcommittee has also cooperated in a Joint I.E.S.-S.M.P.T.E. Committee on Equipment Performance Ratings, in the preparation of a "Recommended Practice for Reporting the Photometric Performance of Incandescent Filament Lighting Units Used in Theatre and Television Production." This subcommittee has also assisted the School Lighting Committee in the preparation of material on the lighting of school stages.

All six subcommittees are preparing reports on recommended lighting practice in their respective fields. Several of these are shaping up in a manner indicating possible completion in the 1957-1958 Society year.

Light Control

Eric H. Church, Chairman

The work of the Committee consists of the assignment to revise one section of the *IES Lighting Handbook* and to

prepare material for writing up a complete Guide Book on Light Control and Equipment Design. The Committee had four meetings during the year with five reports being completed, balloted on and in the process of being submitted to the Council. The five reports consist of the following:

(1) Specifications for polystyrene used in fluorescent luminaires.

(2) Mathematics of reflective design and control.

(3) Basic fundamentals of optical refraction, graphical methods.

(4) Mathematical and practical concepts of shielding.

(5) Physics of light control.

Light Sources

E. H. Salter, Chairman

During the year the Committee held six meetings. The major assignment undertaken by the Committee has been the revision of Sections 1 and 8 of the *IES Lighting Handbook*. In addition, progress has been made on:

(1) The accumulation of data for continuing the Question and Answer page in ILLUMINATING ENGINEERING.

(2) The report on the effect of high and low ambient temperature, drafts, etc., on the starting, light output and color of fluorescent lamps.

(3) The work of the subcommittee, under the Chairmanship of Miss Dorothy Nickerson, on the development of a method of measuring and specifying the color rendition properties of light sources.

Maintenance

Francis Clark, Chairman

The Committee recognizes that there are three basic factors which affect the maintenance of usable light in any lighting installation:

(1) Depreciation of the light source from age.

(2) Depreciation of the light source and the luminaire from dirt accumulation.

(3) Depreciation of walls and ceilings from dirt accumulation and deterioration of finishes.

Subcommittee A, assigned to Aging of Light Sources, is collecting data on deterioration of the source as affected by age.

Subcommittee B, assigned to the Dirtometer, is studying the depreciating effect of dirt accumulation on sources and luminaires. In the February 1955 issue of ILLUMINATING ENGINEERING, there appeared the first formal mention of the Dirtometer. This instrument was devised by three members of the Lighting Maintenance Committee to provide a means for accurate measurement of rate and density of dirt accumulation on luminaires and lamps. The most common planes of luminaires were duplicated and provision made for measurement of reflectance and transmission in these planes. During several meetings of the committee, various changes were recommended to decrease deviations in recording and to improve accuracy. These were made and the instrument refined to the point where it is today.

Subcommittee C, assigned to Walls and Ceilings, is studying the effect of dirt accumulation on and depreciation of finishes on these surfaces. It is expected to reach the same type predictions of light lost in these areas. Also considered in this work is the fact of appreciation from fading of wall and ceiling finishes and from the deposit of light colored dirt on darker surfaces.

Subcommittee D has been assigned to correlating the results of the studies of Subcommittees A, B, and C.

Subcommittees E and F have been assigned to study of possible accelerated tests employing photometer inclosures to measure dirt accumulation on luminaire and source.

Motor Vehicle Lighting

Ray P. Teele, Chairman

The Committee first prepared a set of "Tips to the Motorist" in 1955 for the Safe-Driving Day campaign. This year the safety campaign was enlarged to a year long "Back the Attack on Traffic Accidents" and the Committee revised and enlarged the "Tips" for use in this campaign. At its February meeting there was a demonstration of windshield cleaning methods. Consideration of proposed systems of rear lights was continued. The Committee feels that the development of a uniform system of rear lights will eliminate many fatal accidents by reducing the confusion caused by the multiplicity of designs now displayed on cars.

Nomenclature

Priscilla Presbrey, Chairman

The major part of the Committee's effort this year has been directed to the revision of Section 3, Standards, Nomenclature, Abbreviations, and Symbols, for the third edition of the *IES Lighting Handbook*. Portions of the current Section 3 dealing with electrical terms and abbreviations and symboys were removed, and definitions of a large number of general lighting and lighting application terms were added; the section on color terms was rewritten. The revision of ASA Z7.1-1942, Illuminating Engineering Nomenclature and Photometric Standards, has been advanced by the acceptance of two completely revised sections: 20, Color, and 50, Aeronautic Lighting, the latter prepared by the Committee on Aviation Lighting. Slight changes in the definitions of a few fundamental terms in Sections 05 and 10 were also approved by Council. Work on other sections of Z7, looking toward the publication of a complete new edition, will continue during the coming year.

Office Lighting

G. Franklin Dean, Chairman

The main project of the year was the preparation of material for the Office Lighting Section for the forthcoming revision of the *IES Lighting Handbook*.

Two meetings of the main Committee were held. At the first meeting in conjunction with the Boston National Technical Conference an editorial subcommittee for the *Handbook* project was selected. The second meeting was held in early May to review the material submitted by the subcommittee and to resolve contentious points.

Three meetings of the editorial subcommittee were required to produce the text and select suitable photographs for the *Handbook*.

Through the excellent co-operation of the entire main Committee and especially the subcommittee, the manuscript was forwarded to Society Headquarters in time to meet the deadline set by the Handbook Revision Committee.

In connection with the *Handbook*, the Committee on Nomenclature requested a list of terms applying specifically to Office Lighting. The list was prepared by the Handbook revision subcommittee.

At the request of the Lighting Design Practice Committee, the members of the Office Lighting Committee were asked to submit their interpretations of the current definition of Maintenance

Factor. The number of replies indicated a wide interest in maintenance and varied interpretations of the definition.

Progress

James H. McCulloch, Chairman

The Committee maintained contact with the art of lighting throughout the world and prepared the yearly review of the achievements in the art of lighting for publication in ILLUMINATING ENGINEERING. This review was given a dramatic presentation as one of the features of the 1957 National Technical Conference in Atlanta.

Public Conveyances

E. Boghosian, Chairman

The Committee held one meeting during the year. Work was concentrated on revisions to the *IES Lighting Handbook* and was divided between the Marine Subcommittee and the Land Transportation Subcommittee. Each subcommittee prepared a manuscript of revisions covering its own field and these manuscripts were forwarded to the Handbook Revision Committee in June.

Work by the Land Transportation Subcommittee on a Recommended Practice is being continued. Material included in the *Handbook* revision will be used as a basis for the Recommended Practice.

Draft #5 of "Recommended Practice for Marine Lighting" was prepared and reviewed by the Marine Subcommittee. Subject to certain minor revisions, this is considered as the final draft and will be submitted for Council approval.

Residence Lighting

Frank J. Marriett, Chairman

The work of the subcommittee for the revision of "Contemporary Lighting in Modern and Traditional Interiors" is nearing completion. The Committee plans to re-title the booklet when it is republished. The new text and illustrations will make the new publication more interesting and readable to lay readers.

The subcommittee on "Outline for Training Program" is continuing work on this project. The subcommittee on "Performance of Portable Lamps" has rendered several preliminary reports on this phase of its assignment. Work is progressing as fast as possible with the limited trained personnel and limited laboratory facilities available for this work.

School Lighting

J. M. Chorlton, Chairman

The principal activity of the Committee has continued to be the review of proposed revisions in the American Standard Practice of School Lighting, 1948. The Committee has received reports through the year on the deliberations of the joint Task Committee composed of the Society's representatives along with those of the School Committee of the American Institute of Architects and the National Council of Schoolhouse Construction, co-sponsors of the American Standard Practice of School Lighting.

Several members of the Committee continued securing experimental data on the effects of the reduction of contrast on visual problems in the school room and these results were studied in relation to some of the current research being carried on in projects of the Illuminating Engineering Research Institute.

Searchlight

John A. Bartelt, Chairman

The Committee held a meeting at Rochester in October with the Bausch and Lomb Company acting as hosts. The agenda included reports by subcommittee chairmen, several interesting technical papers and a tour of several departments of the Bausch and Lomb plant. Appointment of a task subcommittee for the *IES Lighting Handbook* revisions was announced.

A "Guide for Photometric Testing of Searchlights," prepared by a subcommittee of the Searchlight Committee, and submitted last year to the Society's Testing Procedures Committee, was approved during this year by Council.

Subcommittees continued their respective programs as follows:

Nomenclature — Ernest Boghosian, Chairman. A report on Nomenclature, containing a list of 50 definitions was prepared by the subcommittee. This report was approved by the full Committee. Ten definitions were selected by the subcommittee for publication in the Handbook at the request of the Society's Nomenclature Committee. The selection of ten definitions was approved by the Searchlight Committee and submitted to the Nomenclature Committee.

Visibility of Targets — L. R. Noffsinger, Chairman. A study is being made of literature in this field, for the purpose of preparing a compilation and evaluation thereof.

Visibility of Sources — W. A. Pennow, Chairman. This subcommittee is continuing its review of literature in this field.

Light Sources—R. E. Faucett, Chairman. A form for listing pertinent characteristics of searchlight sources has been prepared. A tabulation on this form of a number of typical sources is being circulated to the Committee for approval. It is intended that this tabulation, if approved, be submitted to the Society's Light Sources Committee for consideration and eventual publication as an aid to searchlight designers.

Optics — D. Peterson, Chairman. This subcommittee is studying reflector-source relationships. The subcommittee has also plans to tabulate commercially available reflectors with a listing of pertinent characteristics.

Bibliography—J. P. Latil, Chairman. This subcommittee has continued to compile references of interest in this field. A fifth supplementary list of references was mailed to Committee members in January.

Task Subcommittee on Handbook Revision — T. H. Projector, Chairman. This subcommittee met and prepared a draft of a number of proposed revisions to Sections 4, 8, 11 and Appendix A of the *Handbook*. This draft was approved by the Searchlight Committee and was submitted to the Handbook Revision Committee.

Signal Lighting, Elements of

F. C. Breckenridge, Chairman

The Committe reports no progress, as none of the authors has met the schedule and no manuscripts have been submitted.

Sports and Recreational Lighting

Wallace W. Weld, Chairman

The Committee held several meetings during the past year and completed necessary revisions for the *IES Lighting Handbook*. The text was revised to clarify and to bring up to date various sections where necessary. The current Recommended Practice for Sports Lighting also has been thoroughly re-

viewed. The Committee also added 18 new sports lighting layouts, which about completes the coverage of the outdoor sports.

Standards of Quality and Quantity for Interior Illumination

Glenn A. Fry, Chairman

The Committee completed its work on project #6 carried on during the past seven years, and in February submitted for Council approval the report "Avoidance of Discomfort Glare in the Design of Lighting Installations."

Store Lighting

C. M. Cutler, Chairman

One of the major activities of the Committee this year was the revision of the *IES Lighting Handbook* material pertaining to Store Lighting. This was completed and sent in on schedule with Committee approval.

Further work was done on the draft of the Store Lighting Guide. At the last meeting specific assignments were made in order to expedite completion.

The Subcommittee on Parking Areas and Service Stations after a lengthy discussion with the same Subcommittee of the Street Lighting Committee arrived at an agreement regarding footcandle recommendations for parking area lighting. A recommendation of parking area lighting practice has been completed and has been sent out for ballot approval.

Service Station Lighting material has been prepared for the *IES Lighting Handbook*. This includes the levels agreed upon with the Street Lighting Subcommittee. This was sent to the members for approval.

A member of this subcommittee also represents the Operations and Engineering Committee of the Division of Marketing of the American Petroleum Institute. As a liaison member, he has an opportunity to carry the work of the subcommittee to the petroleum industry.

Street and Highway Lighting

George K. Glass, Chairman

The work of this Committee is carried on by various subcommittees with final reports and recommendations requiring nearly unanimous approval of the full Committee. The following is the status of the projects of the more active subcommittees.

Tunnel and Underpass Lighting — Chairman, R. M. Swetland. The interim report of this subcommittee was approved by Council. The subcommittee's studies will continue to include results of future tests and research and to develop a recommended practice.

Visibility Under Fog Conditions — Chairman, E. E. Paul. The research project sponsored by this subcommittee, at Pennsylvania State University and the University of Michigan is progressing very satisfactorily. A paper on the subject was given at the Atlanta Technical Conference in September.

Parking Area Lighting — Chairman, W. H. Edman. The committee's work has been completed on this task. The results and recommendations have been turned over for review to the subcommittee on Lighting Service Station and Parking Areas of the Store Lighting Committee.

Pavement Surfaces — This subcommittee was headed by F. D. Wyatt, until his death in May of this year. The data obtained under Research Fund Project #22 at the University of Illinois are currently under study.

Luminaire Maintenance — Chairman, H. E. Wall. This subcommittee has presented several interesting reports on its tests and studies directed toward substantiating the maintenance factors used in street lighting calculations and to strengthen the recommendations made in the American Standard Practice. Investigations are being carried out on the newer light sources.

Research — Chairman, D. A. Toenjes. This subcommittee coordinates for the full Committee all the various research projects both underway and proposed, of interest in roadway illumination. They also have undertaken an analysis of instruments available and under development for visibility measurements and comfort evaluation. Another important activity has been participation in the reflectance studies of the Pavement Surfaces subcommittee.

Standard Practice — Chairman, C. A. B. Halvorson. The new revision of the American Standard Practice has been started by this subcommittee.

Roadway Lighting Principles — Chairman, C. H. Rex. At the Chicago spring meeting of the full Committee a resolution was unanimously adopted, recognizing the outstanding work done in connection with finding a means of measuring by calculation and instrumentation an "index of merit of visibility" for future consideration in the Code of Street and Highway Lighting.

Lighting for High Speed Heavy Traffic Density Highways — Chairman, P. B. Clark. The major assignment of this subcommittee is to evaluate all data pertaining to illumination of expressways.

Mercury Vapor Lamp — Chairman, J. W. Young. This subcommittee has continued to provide the full Committee with interim reports on all mercury sources. It is planned to combine this subcommittee with the Fluorescent Lighting Subcommittee to provide a Sources Subcommittee with the assignment of providing technical data on all light sources of value in roadway illumination.

Handbook — Chairman, G. E. Korten. This subcommittee has provided the Handbook Revision Committee with recommended changes and additions for inclusion in the forthcoming revision of the *IES Lighting Handbook*. It has kept informed as to activities of other organizations bearing on roadway illumination, especially in the work of the Highway Illumination Committee of the American Road Builders Association.

Interchange With Foreign Groups — Chairman, W. H. Edman. This subcommittee kept informed as to roadway lighting practice, codes, new developments, etc. in the European countries, Australia and elsewhere.

Testing Procedures for Illumination Characteristics

A. E. Krawcek, Chairman

The following progress has been made by this Committee on its principal assignments, during the course of the meetings of the Handbook Revision Steering Committee, the other subcommittees, and the entire Committee which held three two-day meetings.

Guide for Photometric Testing of Indoor Fluorescent Luminaires (Revision of 1948 issue) — G. A. Horton, Chairman. Revision of this Guide is now in progress.

Guide for Photometric Measurement of Fluorescent Lamps (Revision of 1948 issue) — A. W. Weeks, Chairman. This Guide was completed and approved by Council at its June meeting (Published in ILLUMINATING ENGINEERING, October 1957).

Guide for Photometric Testing of Floodlights of 10 to 160 Degrees Total

Beam Spread (Revision of 1950 issue) — J. S. Franklin, Chairman. A subcommittee was appointed by the Chairman to bring this Guide up to date.

Guide for Use of Portable Photometers (Revision of 1937 Report) — G. A. Horton, Chairman. Work on this Guide is in progress.

Guide for the Photometric Testing of Outdoor Fluorescent Luminaires—J. S. Franklin, Chairman. This Guide has been completed and was approved by Council at its June meeting.

Guide for Photometric Testing of Searchlights — A. E. Krawcek, Chairman. This Guide was written with the cooperation of the Searchlight Committee, T. H. Projector, Chairman. It has been completed and was approved by Council at its June meeting.

Guide for the Photometric Measurement of Mercury Vapor Lamps — J. S. Franklin, Chairman. The fourth draft of this Guide has been submitted to the entire committee for review and comments.

Practical Guide to Photometry — Phelps Meaker, Chairman. Work is in progress on this Guide.

Guide for Reporting Lighting Equipment Engineering Data — Elden Witte, Chairman. This Guide has been completed and has been approved by letter ballot of the Committee.

Practical Guide for Brightness Measurement — Paul H. Lamson, Chairman. A draft of this Guide has been completed by the subcommittee and submitted to the entire Committee for comment.

Guide on Colorimetry—Ray P. Teele, Chairman. Work is progressing on this Guide.

Handbook Revision. Section IV of the *IES Lighting Handbook* was assigned to this subcommittee for revision. Phelps Meaker acted as general chairman and A. W. Weeks as Chairman of the Steering Committee. The revised text has been completed, approved by the entire Committee and submitted to the Handbook Revision Committee.

Television — Lighting for Production

Walter H. O'Meara, Chairman

The Committee completed its project started in 1955 toward the establishment of a uniform standard for rating equipment performance. The resulting report "Proposed Recommended Practice for Reporting the Photometric Performance of Incandescent Filament Lighting Units used in Theatre and Television Production" was submitted to Council for approval in June.

Three subcommittees worked on this project—a Subcommittee of this Committee, a Subcommittee of the S.M.P.T.E. Television Lighting Committee, and a Subcommittee of the Society's Theatre Lighting Subcommittee.

1958 Regional Conferences, I.E.S.

Region	Place	Date
Northeastern	Statler Hotel Hartford, Conn.	April 10-11
East Central	John Marshall Hotel Richmond, Va.	April 14-15
South Central and Southeastern	Lafayette Hotel Little Rock, Ark.	April 24-25
Southwestern	Washington Youree Shreveport, La.	April 28-29
Midwestern	Hotel President Kansas City, Mo.	May 1-2
Inter-Mountain	Whitman Hotel Pueblo, Colo.	May 8-9
South Pacific Coast	El Cortez Hotel San Diego, Calif.	May 14-15
Pacific Northwest	Multnomah Hotel Portland, Oregon	May 22-24
Great Lakes	Sheraton Hotel Rochester, N. Y.	June 23-24

LIGHTING NEWS

Store Lighting Is Subject Of Michigan Conference

An afternoon session on design and an evening program on applications in store lighting attracted 250 architects, consulting engineers, manufacturers representatives, utility representatives, displaymen and store owners to the Michigan Section's Store Lighting Conference, September 17.

The topics and speakers for this highly successful meeting, worked up by Program Chairman Stephen Spillace, of Hyde & Bobbio, were:

Afternoon — Design Session

Opening Remarks — James F. Finn, Detroit Edison Co., Chairman, Michigan Section.
Interior General Store Lighting Design — Charles Amick, Day-Brite Lighting Inc., St. Louis, Mo.
Examples and Design of Supplementary Lighting — Richard Smart, Sylvania Electric Products Inc., Clevelaad, Ohio.
Panel Discussion — Questions and Answers.

Evening — Application Session

How to Select Lighting Fixtures for Your Store — Charles Amick.
Lamps and Colors To Use in Your Store — Richard Smart.
Today's Store Lighting in England — Hugh Olson, Courtney-Pope, London, England.
Question and Answer Period.

Dinner was served, between the sessions, in the Detroit Edison Restaurant.

The organization work preparing for this conference included five breakfast meetings of the fifteen-man Conference Committee and the ten subcommittees responsible for the all-important details.

Technical Manpower — Theme For ASEE Meeting

New Concepts in the Education and Development of Technical Manpower is the theme for the 1958 College-Industry conference of the American Society for Engineering Education which is to be held at the University of Michigan, January 30 and 31.

Four speakers are scheduled to present the new concepts arising from current research: Paul Reinert, President of St. Louis University; Andrew A. Kucher, vice-president of engineering and research for the Ford Motor Co.; Donald C. Pelz, University of Michigan Survey Research Center; Lee Danielson or John W. Riegel, U-M Bureau of Industrial Relations.

In addition, programs designed by industries to utilize new concepts of professional developments will be discussed by: W. R. Collings, President, Dow-Corning Corp.; E. E. Sivacek, Chief Engineer, King-Seeley Corp.; A. L. Bain, Engineering Training, Western Electric Co.; L. V. French, Director of Engineering Personnel, Whirlpool-Seeger Corp.

Registration will be held the morning of January 30 and adjournment the afternoon of January 31. For additional information, write the University of Michigan, College of Engineering, 255 West Engineering Building, Ann Arbor, Mich.

PARTICIPATING in the Store Lighting Conference sponsored by the Michigan Section are, left to right: Charles Amick, speaker; Stephen S. Squillace, program chairman; James F. Finn, Section chairman, and Richard Smart, speaker.

Vancouver Island Chapter Flies High

Members of the Vancouver Island Chapter took to the air-lanes recently when they toured Patricia Bay Airport, Canada's fourth largest in passenger traffic, 16 miles north of Victoria. The tour, including Pacific Northwest Regional V-P Kenneth Reid, viewed the airport's high-level lighting system in all phases of operation.

Also in attendance were photographers from the Canadian Broadcasting Corp., Television News Service, who filmed the event and the dinner meeting preceding the tour, for appearance on CBUT, Channel 2, Vancouver.

Michigan Section Circulates Newsletter

A five-page multilith newsletter is being used by the Michigan Section of I.E.S. to keep its members informed on local activities, campaigns, contests and meetings. The first issue of this year also contained a brief report on the National Technical Conference in Atlanta — at least that aspect of it where the Michigan Section won first prize in the national membership campaign for securing most new members.

Here and There with I.E.S. Members

NEWLY elected Fellows of I.E.S., T. H. Shepherd and J. Roy Jones, show their certificates to other members of the Southern California Section at the Section's October meeting.

REGIONAL Activities meeting, in Montreal on November 1, was under the chairmanship of J. C. Wilson, Canadian Regional Vice-President. Left to right, standing: H. D. MacMackin, W. P. Beasley, J. P. Gailloux, J. Lafontaine, A. E. Danes, Joe Thomas, Wally Moore, A. D. Miller, J. W. Bateman, J. Wickett, G. A. Watters, G. F. Dean; seated: E. I. Machtinger, J. E. Shepherd, A. D. Hinckley, J. C. Wilson, C. Roy Hodge, and J. M. Chorlton. Also present at the meeting were J. H. Rylance and C. R. Thornton

PART fun, part technical forum — the combination makes up the annual New England Section outing. Shown here at the Hillview Country Club, North Reading, Mass., are, left to right: John Young, George Almy, Harold Crafts (in rear), Frank A. Sullivan, Jim Patrick, Ed Quintilliani, Fred Vorlander, and Larry Cooke.

British I.E.S. Schedules 1958 Summer Meeting

The next summer meeting of the British Illuminating Engineering Society has been scheduled for May 11-14, 1958 in Eastbourne, England.

The meeting will open with a display of lighting equipment at the Grand Hotel. On the next three days the following papers will be presented and discussed:

Lighting Trends Since 1945: A Survey of Commercial, Industrial and Display Lighting — Dr. H. H. Ballin
Hotel Lighting — W. R. Stevens and C. Dykes Brown
Lighting and Architecture—G. Grenfell Baines and A. L. Hogg
Lighting in Finland — E. Paivarinne
Lighting at the Brussels International Exhibition — A. Boereboom
Lighting Glassware — D. Shellshear and G. D. Cartwright.

The meeting will conclude with a Dinner-Dance at the Grand Hotel on the evening of May 14, when the guest of honor will be Lord Chandos.

Organization Plans Continue For Plastics Institute

Plans for the formation of a Plastics Institute, under the sponsorship of the Society of Plastics Engineers, continue with the appointment of subcommittee chairmen by Jerome Formo, Chairman of the Committee for the Institute. These subcommittees and their chairmen are:

1. Charter and Name — Eugene C. Quear
2. Administrative and Operating Policy — H. H. DuBois
3. Location and Affiliation — Gordon M. Kline
4. Finance and Budget — Haiman S. Nathan
5. Organization and Personnel — William O. Bracken
6. Liaison — Jean O. Reinecke
7. Research Projects — Frank C. McGrew
8. Library — Arnold M. Varner
9. Public Relations — Allan A. Hutchings
10. Patent — Louis F. Rahm

Standards Conference Held On West Coast

The Eighth National Conference on Standards, held November 13-15 at the St. Francis Hotel, San Francisco, Calif., marks the first time these annual meetings have traveled to the Far West. The eleven sessions, held in parallel, covered the following topics:

Annual Meeting of the American Standards Association
Government and Industry Use of National Standards
Standards--Control of Exposure from Ionizing Radiation
Cost Improvement Through Standardization
Partnerships in Standardization: Purchasing, Engineering and Design
Standardization in Your Company
Profiting by Standards in the Railroad Industry
Industrial Standardization for Defense

(*Continued on page* 12A)

SCHEDULED EVENTS

December 1-6, 1957 — The American Society of Mechanical Engineers, Annual Meeting, Hotel New Yorker, New York, N. Y.

December 12, 1957—Council Meeting, I.E.S., New York, N. Y. Members are free to attend meetings of Council as guests.

January 27-29, 1958 — American Society of Heating and Air-Conditioning Engineers, Incorporated, Annual Meeting, Pittsburgh, Pa.

February 3-7, 1958 — American Institute of Electrical Engineers, Winter General Meeting, Hotel Statler, New York, N. Y.

February 9-15, 1958 — National Electrical Week.

February 13, 1958—Council Meeting, I.E.S., New York, N. Y. Members are free to attend meetings of Council as guests.

February 20-21, 1958 — 14th Annual National Wiring Promotion Conference, Statler Hotel, Detroit, Mich.

March 2-5, 1958 — National Electric Sign Association, National Convention, Shamrock Hilton Hotel, Houston, Texas.

April 10-11, 1958 — Northeastern Regional Conference, Statler Hotel, Hartford, Conn.

April 14-15, 1958 — East Central Regional Conference, John Marshall Hotel, Richmond, Va.

April 20-26, 1958 — Society of Motion Picture and Television Engineers, Ambassador Hotel, Los Angeles, Calif.

April 24-25, 1958—South Central and Southeastern Regional Conference, Lafayette Hotel, Little Rock, Ark.

April 28-29, 1958 — Southwestern Regional Conference, Hotel Washington Youree, Shreveport, La.

April 30, 1958 — Council Meeting, I.E.S., Hotel President, Kansas City, Mo. Members are free to attend meetings of Council as guests.

May 1-2, 1958 — Midwestern Regional Conference, Hotel President, Kansas City, Mo.

May 8-9, 1958 — Inter-Mountain Regional Conference, Whitman Hotel, Pueblo, Colo.

May 14-15, 1958 — South Pacific Coast Regional Conference, El Cortez Hotel, San Diego, Calif.

May 22-24, 1958 — Pacific Northwest Regional Conference, Multnomah Hotel, Portland, Oregon.

June 8-12, 1958 — National Association of Electrical Distributors (50th Anniversary Convention), Civic Auditorium, San Francisco, Calif.

June 9-13, 1958 — National Association of Electrical Distributors, 50th Annual Convention, San Francisco, Calif.

June 12, 1958 — Council Meeting, I.E.S., New York, N. Y. Members are free to attend meetings of Council as guests.

June 23-24, 1958 — Great Lakes Regional Conference, Sheraton Hotel, Rochester, N. Y.

June 23-27, 1958 — American Institute of Electrical Engineers (Summer General Meeting), Buffalo, N. Y.

August 17-22, 1958 — Illuminating Engineering Society (National Technical Conference), Royal York Hotel, Toronto, Canada.

August 19-22, 1958 — American Institute of Electrical Engineers, Pacific General Meeting, Sacramento, Calif.

September 22-25, 1958 — Institute of Traffic Engineers (Annual Meeting), McAllister & Columbus Hotels, Miami, Florida.

October 8-10, 1958 — Canadian Electrical Manufacturers Association (14th Annual Meeting), Sheraton Brock Hotel, Niagara Falls, Canada.

October 13-15, 1958 — National Electronics Conference, Inc., Hotel Sherman, Chicago, Ill.

October 19-24, 1958 — Society of Motion Picture and Television Engineers, Sheraton-Cadillac Hotel, Detroit, Mich.

October 20-24, 1958 — National Safety Council (46th National Safety Congress & Exposition), Chicago, Ill.

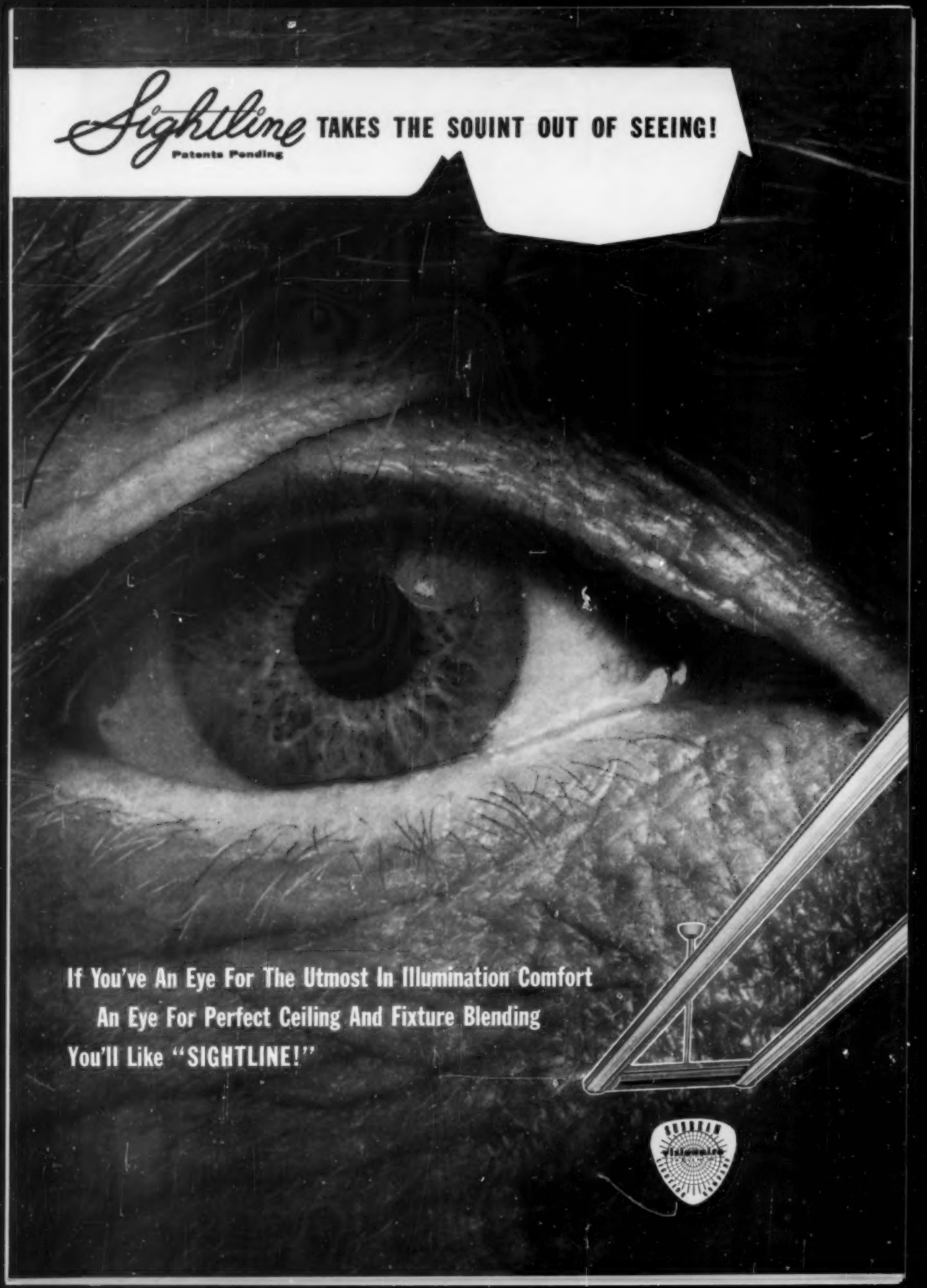
October 27-31, 1958 — American Institute of Electrical Engineers (Fall General Meeting), Pittsburgh, Pa.

November 10-14, 1958 — National Electrical Manufacturers Association (Annual Meeting), Traymore Hotel, Atlantic City, N. J.

November 18-20, 1958 — American Standards Association (9th Annual Conference on Standards), Hotel Roosevelt, New York, N. Y.

I.E.S. National Technical Conferences

1958 — August 17-22 — Royal York Hotel, Toronto, Ontario
1959 — September 7-11 — Hotels Fairmont and Mark Hopkins, San Francisco, California
1960 — September 11-16 — Penn Sheraton Hotel, Pittsburgh, Pennsylvania
1961 — September 24-29 — Chase Park Plaza Hotel, St. Louis, Missouri
1962 — September 9-14 — Statler-Hilton Hotel, Dallas, Texas


Sightline TAKES THE SQUINT OUT OF SEEING!
Patents Pending
If You've An Eye For The Utmost In Illumination Comfort
An Eye For Perfect Ceiling And Fixture Blending
You'll Like "SIGHTLINE!"

A true milestone in comfortable seeing, Sunbeam Lighting's new SIGHTLINE is a suspended indirect lighting system that creates a velvet-soft visual environment in which seeing becomes a pleasure, not a chore. SIGHTLINE'S engineered uniform low brightness ratios assures 'no over-head-feeling.' SIGHTLINE illumination keeps the eye on the task not the luminaire.

Excels in any environment where critical viewing conditions exist; schools, drafting rooms, offices, etc. SIGHTLINE exceeds most ASA standards and accommodates higher lumen lamps for greater intensities of comfortable illumination.

Ballast housed cross-channels are 8′ apart, another contributing factor in SIGHTLINE'S clean and modernly linear appearance. Patented spring loaded bottom swivel enables SIGHTLINE to hang with anchored levelness and appealing architectural poise. Normal maintenance can be achieved without removing plastic panels. All metal parts are Bonderized against corrosion and finished in all white baked enamel. Write for bulletin #773 for more details on how to take the squint out of seeing.

SUNBEAM LIGHTING COMPANY

777 E. 14th Place, Los Angeles 21, California
3840 Georgia Street, Gary, Indiana

(*Continued from page* 9A)

Value of Standards in Construction Specifications
How Standards Help the Motion Picture Industry
Standardization for Technical Communication

At the Annual Award Dinner, November 14, the Standards Medal was presented to John R. Townsend, and the Howard Coonley Medal to Roger E. Gay.

The Conference is sponsored annually by the American Standards Association.

Architectural Students Attend Allied Arts Seminar

Eighteen fifth-year seniors at Pennsylvania State University attended an Allied Arts seminar, sponsored by Karl Staley, Chairman of the Society's National Committee, jointly with the Pittsburgh Section Allied Arts Chairman, Lucien T. Kight of Duquesne Light.

The sessions, which were conducted, mainly, at the University Park campus, also included a tour with Committee members McNall, Thomas and Maguire. Students were driven to Lake Erie College, Painesville, Ohio, for an inspection of the new dormitories there, and continued to K. A. Staley's Frank Lloyd Wright home in Madison, Ohio, for supper.

The following day there were continuous sessions on light and lighting at the Nela Park Lighting Institute, including the full range of the new demonstration rooms, a talk by General Electric Co.'s Lighting Education Manager, Willard C. Brown on "European vs American Practice." The finale was inspection of the Cleveland Institute of Art, under the guidance of its director, Joseph McCullough.

The students, who are in the design class of Professor A. William Hajjar, A.I.A., will be given six Allied Arts-type problems, three students each to solve problems in store, office, school, residence, public building and church fields.

GROUP A Panel of judges for the 1957 International Competition, sponsored by the NEMA Lighting Bureau and three McGraw-Hill magazines. Left to right are Professor Russell C. Putnam, C. M. Cutler and Carl W. Zersen.

Winners Announced in International Competition

The international lighting competition, sponsored by NEMA's National Lighting Bureau and three McGraw-Hill magazines, has announced 136 winners in four main divisions of $5400 in cash prizes and 42 winners of Honorable Mention awards. There had been a total of 377 entries from the United States, The Netherlands, Australia and Canada. They were judged under three classifications:

Group A — Industrial, store, office and institutional lighting.
Group B — Outdoor lighting.
Group C — Residential lighting.

Prizes awarded for each classification and within each division were $100 for first, $50 for second and three third prizes of $25 each. Judges were:

Group A — C. W. Zersen, Chicago Lighting Institute; C. M. Cutler, General Electric Co.; Russell C. Putnam, Case School of Applied Science.
Group B — C. L. Crouch, I.E.S.; Everett M. Strong, Cornell University; Charles H. Goddard, Thomas A. Edison, Inc.
Group C — Miss Myrtle Fahsbender, Westinghouse Lamp Division; William F. Little, past president of Electrical Testing Laboratories Inc., Edward A. Campbell, Better Light Better Sight Bureau.

The McGraw-Hill magazines which joined the Lighting Bureau in sponsoring the contest are *Electrical Construction and Maintenance*, *Electrical Wholesaling* and *Electrical World*.

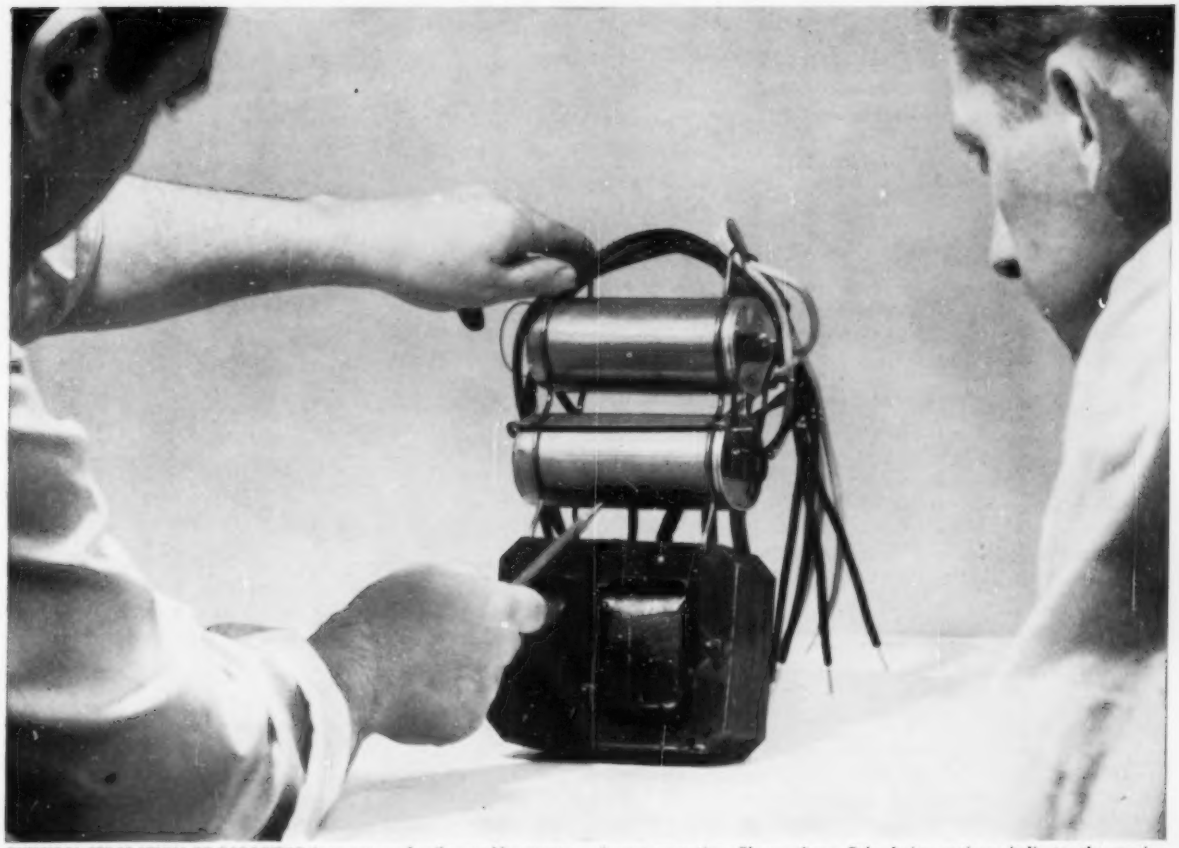
ALLIED Arts Students visit Nela Park Lighting Institute. Left to right, first row: Professor Pass, Frey, Maguire, Hollenbach, Whitmore, Professor Hajjar, Large, Rogers, Downing, Krashuba. Second row: Grimmson, Thomas, Lindstrom, Spaulding, Knovich, Roblesky, Fisher, Roscoe, Staley. Third row: Grobe, Coats, Kight, McNall, Kyper, Insara.

Applications for Retired Membership

New retired membership classifications became effective in the fiscal year beginning October 1956. Privileges in these new grades, earned by long membership in the Society, include reduced annual dues ($5.00) with continued receipt of all Society mailings including ILLUMINATING ENGINEERING. Such members will be designated as Member, Retired; Associate Member, Retired.

Those who are interested and qualified

(*Continued on page* 14A)



PHYSICAL SEPARATION OF CAPACITOR *from core-and-coil assembly assures protection against capacitor failure due to heat arising from normal transformer operation. Shown above, Sola design engineer indicates the spacing of capacitors (top) from core-and-coil assembly in the Sola transformer.*

Design Feature Protects Capacitor Life in Sola Mercury Vapor Lamp Transformers

Capacitor failure is a major cause of malfunction of outdoor mercury vapor lamp transformers. Almost invariably, heat normally generated by transformer operation is responsible. Sola Constant Wattage Mercury Vapor Lamp Transformers are designed to protect against capacitor failures by providing safe physical separation of capacitor from the core-and-coil assembly.

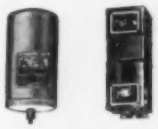
This design feature is indicative of the mechanical and electrical design caliber of Sola Constant Wattage Mercury Vapor Lamp Transformers. The result is superior performance, reliability, and reduced system maintenance cost for outdoor mercury vapor lighting.

Sola Constant Wattage Transformers offer unique electrical characteristics:

- Lamps remain lit even when line voltage dips as low as 75v on a 115v line.
- Energy to lamps is regulated within $\pm 2\%$ in spite of line voltage swings as great as $\pm 13\%$.
- Regulated voltage, current, and wattage permit continuous stable operation — extend lamp life.

When you're next concerned with design, specification or installation of outdoor mercury vapor lighting — shopping centers, parking lots, service stations, playfields, plant area protection — investigate the advantages of Sola Constant Wattage Mercury Vapor Lamp Transformers. Your Sola representative, listed below, will be happy to provide prompt attention to your inquiries.

SOLA *Mercury Vapor Lamp* **TRANSFORMERS**



Write for Bulletin 3L-MV-219
SOLA ELECTRIC CO.
4633 W. 16th Street
Chicago 50, Illinois

CONSTANT VOLTAGE TRANSFORMERS • LIGHTING TRANSFORMERS • CONSTANT VOLTAGE DC POWER SUPPLIES
SOLA ELECTRIC CO., 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • BRANCH OFFICES: Boston, Mass.; Cleveland, Ohio; Kansas City, Mo.; Los Angeles, Calif.; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.; Wallingford, Conn. • *Representatives in Other Principal Cities*
Sola Electric (Canada) Ltd., Toronto 17, Ontario: 102 Laird Drive, Mayfair 4554

(*Continued from page* 12A)

(at least thirty years of membership and 65 years of age) should write to the General Secretary at Society Headquarters, stating that they have retired from regular occupation in business or profession.

Gold Medal Nominations Due by January 1

Nominations of candidates for the 1958 Gold Medal Award are being sought by the Medal Award Committee, for consideration for next year's award. Such nominations must be received at Society Headquarters by January 1, 1958.

Candidates need not be members of the Society or citizens of the United States or Canada. They may be nominated at any time by any member of the Society, by sending to the General Secretary at Society Headquarters the name of the individual deemed worthy of the award.

OPENING ceremonies of the new Chicago Lighting Institute at 140 South Dearborn St. Unlocking the door is Managing Director Carl W. Zersen. Beside him, looking on with a large supporting cast, is Charles Smallwood of the Carroll Construction Co., general contractors for the new headquarters.

Residence Lighting Resource List Available from Headquarters

A 29-page bibliography, compiled by the I.E.S. Residence Lighting Committee, entitled the Residence Lighting Resource List, is available free of charge from the I.E.S. Headquarters, Technical Department.

The list was compiled especially for educators, home advisors and students of home lighting as a guide to current authoritative sources of associated study, research, development and recommended practice. Titles and a short description of each publication are classified according to the following categories: nature of light, light and vision, sources, luminaires, lighting design principles, recommended lighting methods, housekeeping functions, architecture, interior design and furnishings, color, wiring, and visual and teaching aids.

Back Issues of I E Available

Back numbers of ILLUMINATING ENGINEERING, complete from December 1949, are being offered for sale at 25 cents a copy. William P. (Teddy) Bear, a Member Emeritus of I.E.S., is offering the entire lot to anyone wishing to complete his lighting reference library. Inquiries should be addressed to: Wm. P. Bear, 8344 Lullaby Lane, Panorama City, Calif.

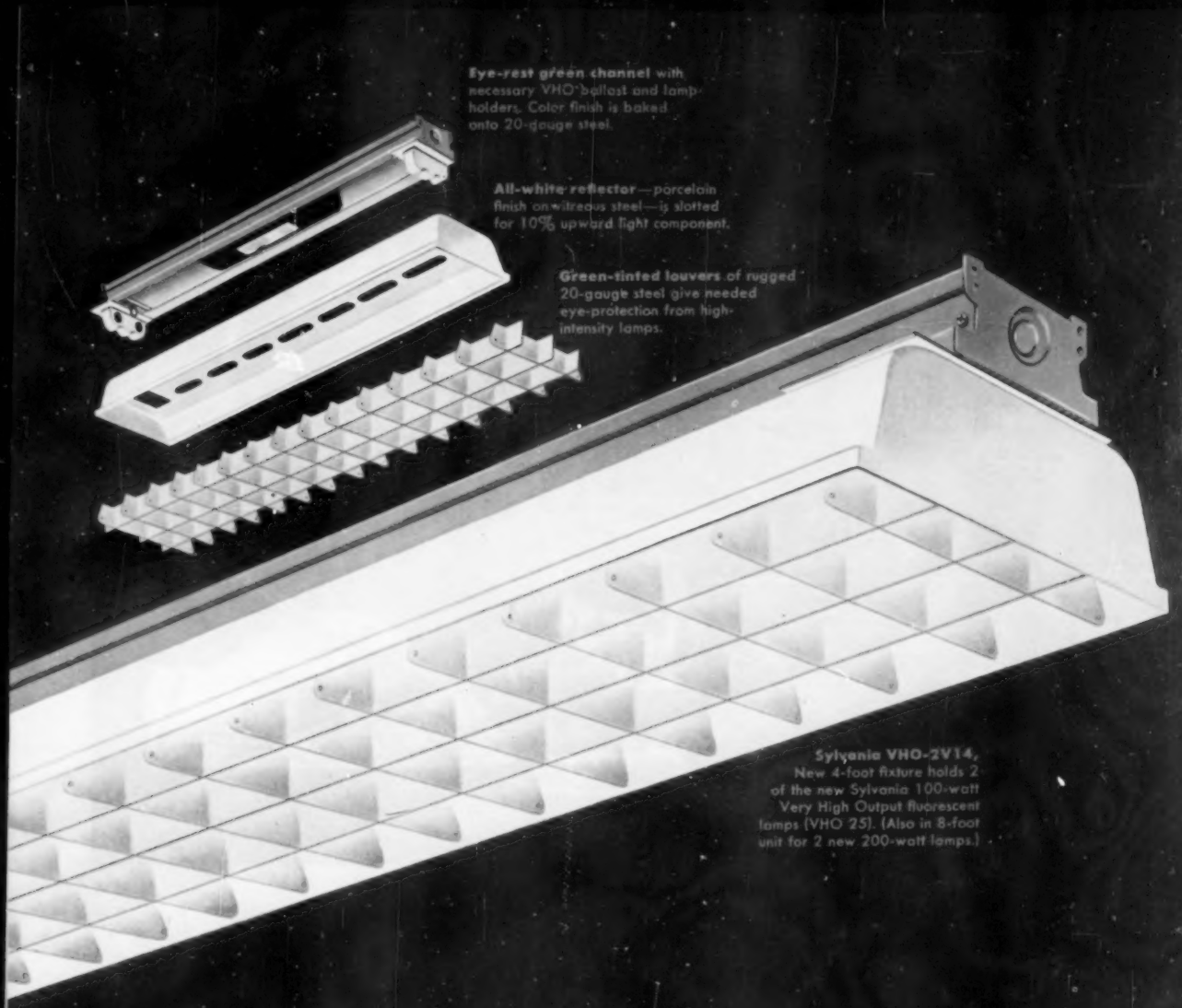
CITATION award is presented to Professor John O. Kraehenbuehl by R. J. Diefenthaler, on behalf of the Chicago Lighting Institute. Left to right at the head table: Thomas G. Ayers, Commonwealth Edison Co.; Ole A. Hill, President of the Institute; R. J. Diefenthaler, Secretary-Treasurer of the Institute; Professor Kraehenbuehl; Kirk Reid, President of I.E.S.; Ivar Viehe-Naess, of Shaw, Metz & Dolio; Ralph Raymond, of Commonwealth Edison; Lloyd Johnson, Commissioner of Streets & Electricity of the City of Chicago. Presentation of the award was made at the dedication luncheon of the Institute's new quarters.

ABOUT PEOPLE

William P. Lowell, Jr., Sylvania Electric Products Inc., was elected President of the RLM Standards Institute, Inc. and a member of the Board of Trustees at the annual meeting of the Institute on October. 15. **J. H. Fall, III,** of Benjamin Electric Mfg. Co., was elected Vice-President and Trustee. **E. F. Mulligan,** Jones Metal Products Co., is Treasurer, and **B. G. Tremaine, Jr.,** The Miller Co., Secretary and Trustee. The Institute has also elected the following Trustees: **L. A. Hobbs,** Smoot-Holman Co.; **E. C. Huerkamp,** Westinghouse Electric Corp.; **J. F. Whitehead, Jr.,** Day-Brite Lighting, Inc.; **D. E. Worrell,** Quadrangle Manufacturing Co.

The Jefferson Electric Co., Bellwood, Ill., announces that **Joseph W. Steiner**

(*Continued on page* 17A)


Eye-rest green channel with necessary VHO ballast and lamp-holders. Color finish is baked onto 20-gauge steel.
All-white reflector—porcelain finish on vitreous steel—is slotted for 10% upward light component.
Green-tinted louvers of rugged 20-gauge steel give needed eye-protection from high-intensity lamps.
Sylvania VHO-2V14, New 4-foot fixture holds 2 of the new Sylvania 100-watt Very High Output fluorescent lamps (VHO 2S). (Also in 8-foot unit for 2 new 200-watt lamps.)

NOW—Light Output Doubled!

New Sylvania VHO Special Fixture Series

for quality lighting with the sensational new fluorescent lamp

Sylvania's new VHO Special Fixture Series harnesses the tremendous light output of the sensational VHO lamps and puts it to work effectively for you.

These higher wattage VHO lamps—recently developed in the Sylvania laboratories—mark a milestone in today's industrial lighting revolution. Though no larger in size, they deliver more than double the light output of regular fluorescents of the same length.

Sylvania's new VHO Special Fixture operates these lamps with a minimum of glare and a maximum of eye comfort. Its "eye-rest" green channel and green tinted louvers add cool chromatic eye-comfort. Its white porcelain reflector is slotted for 10% upward light component to mellow harsh contrasts overhead.

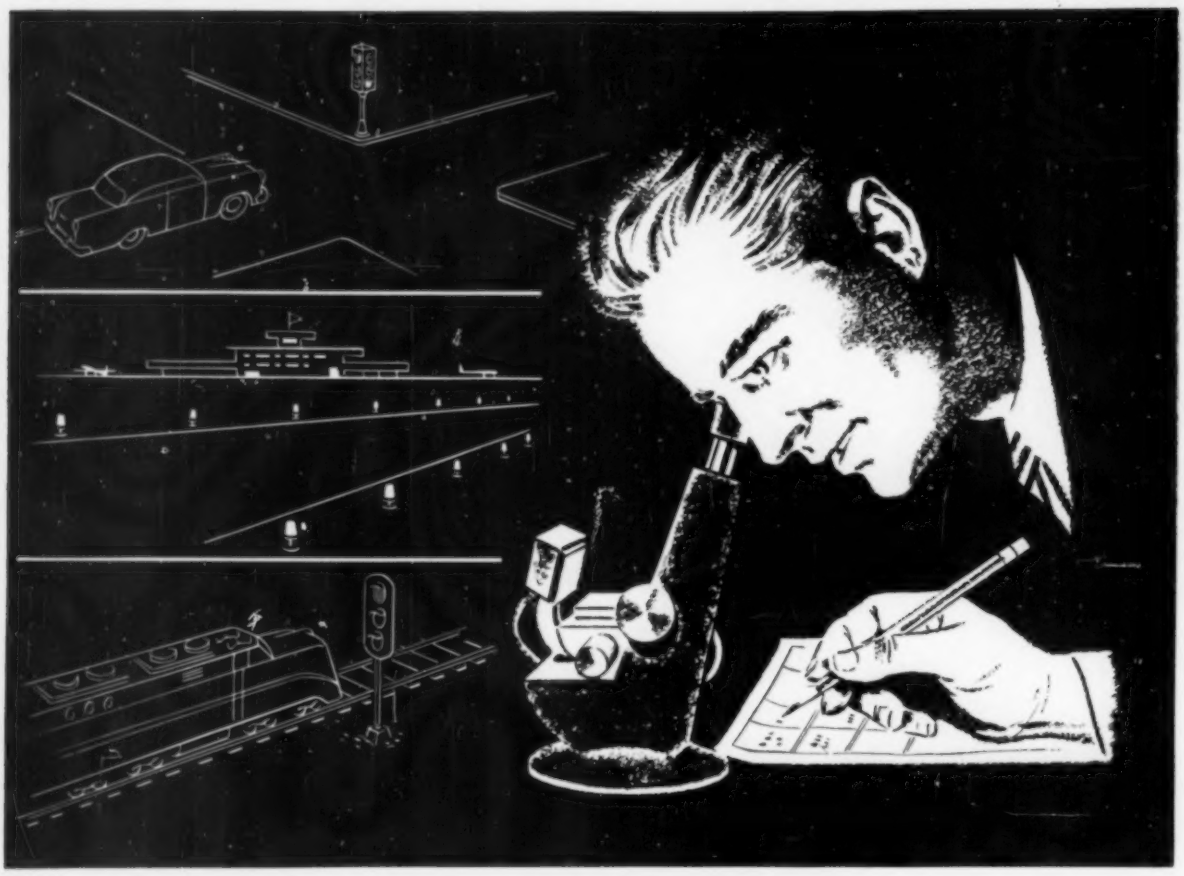
Picture, in your own plant, where these fixtures might work effectively for you . . . in inspection areas or precision machine locations . . . for close tolerance work or for general high-bay areas.

See for yourself what Sylvania's new VHO lighting can do for morale and plant production rates, reducing the number of rejects. See how its one-man maintenance features will cut down operating costs. Talk to your local Sylvania Fixture Specialist, or write direct for full details.

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. M11, Lighting Division—Fixtures
One 48th Street, Wheeling, W. Va.

SYLVANIA
...fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • METALS & CHEMICALS



Solving tough beam control problems

with **Kopp** *specially-designed glass*

Modern glass has many useful properties which when properly engineered provide highly-desirable products for industrial use.

Kopp engineers proportion and mix these properties, as a chef creates a new recipe, to provide an innumerable family of quality products. They are then put through a series of exacting tests—some to destruction—to determine their maximum application values. Production, the same as designing, is carefully controlled to assure products of utmost dependability and performance.

Through the years, our engineering department has developed over 1000 glass items utilizing over 100 varieties of glass. Some were designed to concentrate a beam of light within a limited area, others to diffuse light over a broad area or direct portions of it to definite paths.

Call us today about your specialized glass needs. Our engineering department will be glad to help you.

KOPP GLASS

KOPP GLASS, Inc.

Swissvale, Pennsylvania

(*Continued from page* 14A)

has been appointed to the position of Director of Engineering with the firm. In this newly created post, Mr. Steiner will supervise the work of Project Engineering, Development Engineering and Quality Control Divisions. He was formerly Manager of Interior Lighting Engineering Section with Westinghouse Electric Corp.

G. W. Beals

Gillson W. Beals, veteran Chief Application Engineer of the Illuminating Division, The Miller Co., has retired after more than 40 years with the company. A Fellow of the I.E.S., Mr. Beals will continue in the capacity of consultant to the Illuminating Division Sales Dept.

Ewart M. Haacke has been named Sales Manager, Lighting Division, J. A. Wilson Lighting & Display Ltd. Formerly Eastern District Manager, Mr. Haacke joined the firm in 1951 as Montreal Branch Manager.

The Miller Co. also announces the appointment of **John J. Neidhart** as Manager, Application Engineering. Mr. Neidhart who joined the company in 1956 as Application Engineer, had previously been Lighting Engineer with the Westinghouse Electric Corp. in Cleveland. Mr. Neidhart is a Fellow of the I.E.S.

Brooks Chassaing and **Joseph Chassaing** announce the establishment of a partnership under the name, Chassaing Brothers — Lighting, with offices opened on November 1 at 7603 Forsythe Blvd., Clayton 5, Mo. The new company will represent the Art Metal Co., of Cleveland, Ohio; The Devine Lighting, Inc., Kansas City, Mo.; Sunbeam Lighting Co. of Los Angeles, Calif., and Gary, Ind., in the midwest territory of Missouri, Kansas, Colorado, Wyoming and Southern Illinois. Brooks Chassaing, a Director of I.E.S., has been in the lighting business for 28 years in both sales and administration. Joseph Chassaing has represented the Art Metal Co. for the past three years.

Alvin N. Gray, development engineer, Western Electric Co., Baltimore, Md., was presented with the Manufacturers Medal and Purse, given under the James H. McGraw Award for Electrical Men, at the annual meeting of the National Electrical Manufacturers Association on November 13. Mr. Gray received the award for his development of the Room Temperature Compound Process leading to a broad advance in the technology of extruding natural and synthetic rubber insulations for electrical conductors.

General Electric Large Lamp Dept. has named **Robert J. Schulte** as manager of its Mississippi Valley sales district, effective November 1. He replaces **Bernard H. Sullivan,** manager since July 1946, who retired as of December 1. Mr. Schulte has held sales and engineering assignments with G-E prior to this appointment.

Lyman C. Brenneman, formerly with the General Electric Co. in Plainville, Conn., has accepted a position as the electrical engineer on the staff of Miami University in Oxford, Ohio, having the title of Assistant Director of Buildings.

Westinghouse Electric Corp. has appointed **Robert J. Sampson** as national accounts sales manager of their Lamp Division, with headquarters in Bloomfield, N. J. Mr. Sampson was previously manager of sales training for the division.

Rex L. Zinn has been appointed Lighting Consultant at the new Gary, Ind., plant of Sunbeam Lighting Co. Mr. Zinn comes to Sunbeam from Northern Indiana Public Service Co., where he was Supervisor, Commercial and Industrial Lighting Dept.

Hughey & Phillips, Burbank, Calif., announced the appointment of **Donald F. Beechey** as sales representative for this tower lighting equipment manufacturer in the Eastern Canada territory. Mr. Beechey has his office at 290 Lawrence Ave., West, Toronto 12, Ont.

(*Continued on page* 45A)

Council Meetings — 1958

Members of I.E.S. are invited to attend any meetings of the Council as guests, or to submit a communication for consideration on any matter, through their Regional Vice-President or the General Secretary. Meetings of Council are scheduled for the following dates in 1958.

February 13—New York, N. Y.
April 30 — Kansas City, Mo.
June 12 — New York, N. Y.

EXECUTIVE Committee for the 1958 National Technical Conference meeting in Toronto, November 4. Left to right: Seated, Bill Hawley, Bill Dalrymple, Bob Lindsay, Mrs. H .C. Jones, Joe Bateman, Grant Davidson, Charles Amick, A. D. Hinckley, Ed Machtinger, G. F. Dean; standing, Len Nordby, Gord Wallace, N. Scott, Duncan Jones, R. C. Allison, J. Smith, J. M. Chorlton, R. Slater and E. Wilson.

COMMITTEE PERSONNEL

COMMITTEES 1957-1958

All committees are appointed by the President, subject to approval of the Council. Except as provided in the Constitution, appointments terminate at the time of the first Council meeting of the following administration. The scope of each committee is indicated.

K. M. Reid, President, ex-officio member of all Standing, General and Task Committees.

G. J. Taylor, Vice-President, ex-officio member of all Technical Committees.

STANDING COMMITTEES

COUNCIL EXECUTIVE — To conduct the affairs of the Society between Council meetings.

K. M. Reid, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

J. B. Browder — R. G. Slauer
J. R. Chambers — G. J. Taylor

BOARD OF FELLOWS — To evaluate the eligibility of candidates for transfer to grade of Fellow according to procedures approved by Council.

George E. Shoemaker, Chairman, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia 5, Pa.

Willard Allphin — J. S. Hamel
Leland H. Brown — Roy A. Palmer
Edward Rambusch

FINANCE — To have direct supervision of the financial affairs of the Society and to present to the Council an annual report on its financial condition. To make recommendations to the Council as to the investment of moneys and upon all specific appropriations. To prepare and submit for approval of Council not later than the first new Council meeting a budget of income and expense for the ensuing fiscal year.

W. P. Lowell, Jr., Chairman, Sylvania Electric Products Inc., Salem, Mass.

A. C. Barr — C. C. Keller
J. R. Chambers, ex-officio — R. M. Zabel

GENERAL BOARD OF EXAMINERS — To investigate the qualifications of all applicants for admission to membership; to elect or reject applicants for the grade of Associate Member and Student Member, to report such action to the Council; and to make recommendation to the Council regarding applications for transfer or election to the grade of Member or Retired member, and for transfer to the grade of Member Emeritus.

Ralph H. MacVean, Chairman, Consolidated Edison — Westchester, 9 So. 1st Ave., Mt. Vernon, N. Y.

Svend W. Bruun — H. E. D'Andrade

MEDAL AWARD — To evaluate the eligibility of candidates for award of the I.E.S. Medal according to procedures approved by the Council.

L. E. Tayler, Chairman, Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

Julius Daniels — H. H. Magdsick
R. F. Hartenstein — Hoyt P. Steele
B. J. Jensen — M. N. Waterman
D. M. Jones — J. F. Whitehead

PAPERS — To procure, review and approve all technical papers and discussions thereof, for presentation before National Conferences of the Society.

H. F. Davidson, Chairman, Curtis Lighting of Canada, Ltd., 195 Wicksteed Ave., Leaside, Toronto, Ont.

Floyd W. Sell, Vice-Chairman, The Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

L. E. Barbrow — O. B. Goldsmith
B. S. Benson — S. K. Guth
R. L. Biesele, Jr. — Ted Sargent
F. C. Breckenridge — G. A. Trosper
Kurt Franck — George Wakefield

PUBLICATIONS — To be responsible for the procurement, review and approval of all material for the publications of the Society other than technical papers approved by the Papers Committee for presentation at National Conferences of the Society and their discussions and committee reports, for which it will have publication responsibility only. Shall also be responsible for the editing, printing and business management of the publications of the Society; specific exceptions may be made by Council.

R. M. Zabel, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

Brooks Chassaing — H. F. Davidson
J. R. Chambers — R. W. Morris
J. S. Schuchert

Technical Content

H. F. Davidson, Chairman, Curtis Lighting of Canada Ltd., 195 Wicksteed Ave., Leaside, Toronto 17, Ont.

L. E. Barbrow — O. B. Goldsmith
B. S. Benson — S. K. Guth
R. L. Biesele, Jr. — Ted Sargent
F. C. Breckenridge — Floyd W. Sell
Kurt Franck — G. A. Trosper
George Wakefield

Editorial Content and Technical Data Sheets

R. W. Morris, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

G. J. Anderson, Jr. — Michael N. Flynn
L. T. Johnson

Home Lighting Data Sheets

Eve Freyer, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

REVIEWING SUBCOMMITTEE

Lillian Eddy — Katherine Goodall
Jan Reynolds

CONTRIBUTING SUBCOMMITTEE

Nelson Bleisch — Dorothy McGregor
Mary Dodds — Aileen M. Page
Carolyn J. Epperson — Ruth Patterson
Stella Fetzer — Margaret Summers
Melrose Franklin — Mary Taepke
J. B. Hacker — Dorothea Underwood
Blanche Waggener

Publication Sales

Brooks Chassaing, Chairman, Chassaing Brothers — Lighting, 7603 Forsythe Blvd., Clayton 5, Mo.

GENERAL COMMITTEES

ADVANCE PLANNING — To study the long range objectives of the Society — its operation, program, publication activities, membership classifications and financial structure, and to make recommendations to Council.

F. C. Winkler, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 1, Ohio.

A. C. Sangster, Vice-Chairman, The Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

G. W. Beals — Glenn E. Park
W. P. Lowell, Jr. — L. C. Twichell
J. D. Mitchell — J. D. Whitnel.
A. B. Oday — R. M. Zabel

ADVISORY BOARD TO THE PRESIDENT — To examine the organization, accomplishments, and assignments of committees and prepare not later than July 1 of each year a proposed list of committees and personnel; and to evaluate costs and benefits of present and proposed Society services.

G. J. Taylor, Chairman, Day-Brite Lighting Inc., 161 E. 42nd Street, New York 17, N. Y.

J. B. Browder — R. G. Slauer
J. R. Chambers — M. N. Waterman

ALLIED ARTS — To encourage and assist local competitions in allied arts, in cooperation with technical committees and interested local groups.

Karl A. Staley, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

J. D. Whitnell, Vice-Chairman, Arizona Public Service Co., P. O. Box 2591, Phoenix, Ariz.

Carl Albach — M. B. Moore
C. A. Atherton — Joseph Morbito
Roy Dahlin — Roy Palmer
Eugene Frost — Kenneth Parsons
A. B. Gallion — J. C. Penafeather
J. H. Jensen — R. C. Putnam
A. R. Keeler — J. A. Russell
T. J. Killian — B. J. Sabaroff
Lucien Kight — Foster K. Sampson
J. O. Kraehenbuehl — H. M. Sharp
Onnie Monkki — G. E. Shoemaker
Rollo G. Williams

Agriculture Colleges

J. P. Ditchman, Chairman, General Electric Co,. Nela Park, Cleveland 12, Ohio.

Lighting Lectures

J. I. Tugman, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

BOARD OF NOMINATION — To prepare a nomination ticket containing the names of those who are deemed best suited to serve as officers and directors in positions to be filled at the ensuing election.

Duncan M. Jones, Chairman, Curtis Lighting Co. of Canada, Ltd., 195 Wicksteed Ave., Leaside, Toronto, Ont.

R. F. Hartenstein — M. N. Waterman
and regional representatives

CONSTITUTION AND PROCEDURES — To prepare proposed amendments to the Constitution and By-Laws, to prepare statements of policies and procedures consistent with the Constitution and By-Laws, and to report to Council.

R. F. Hartenstein, Chairman, The Ohio Edison Co., Akron, Ohio.

L. E. Barbrow — C. C. Keller
G. W. Beals — Walter Sturrock
G. F. Dean — L. C. Twichell
N. C. Warner

(*Continued on page* 20A)

Modern Lighting *by* PERFECLITE

makes learning easier on young eyes... increases teaching efficiency

For schools, where visual comfort is such a vital factor in scholastic achievement and physical well being, more and more architects and engineers specify Perfeclite. Case in point —the recently renovated and enlarged Peters Township, Pa. Junior-Senior High School, where one million dollars was spent in repairs and new building. Perfeclite fixtures light the way in classrooms and corridors—help create an ideal environment for students and teachers alike.

In schools, offices, factories—in fact, wherever you have a commercial or institutional lighting problem – there's a low cost, easy-to-install Perfeclite fixture ideally suited to your requirements.

Write today for further information.

INSTALLATION: Peters Township, Pa. Junior-Senior High School.
AREA SHOWN: Typical classroom and corridor.
ARCHITECTS: Beall & Parkins, Washington, Pa.
ELECTRICAL CONTRACTOR: Edward Regula, Belle Vernon, Pa.
FIXTURES: Perfeclite F-387-AT recessed asymmetric drop prismatic lens 200 watt corridor fixtures. Perfeclite P-303 plastic three ring shadowless, non-glare translucent 500 watt ceiling fixtures.
CEILING HEIGHT: 8'6" in corridor —11'10" in classroom.
FIXTURE SPACING: 9'6" in classroom—12'0" in corridor.
INTENSITY: 46 ft.-candles average throughout classroom at desk level. 20 ft.-candles average throughout corridor at locker level.

THE PERFECLITE COMPANY
1457 EAST 40th STREET • CLEVELAND 3, OHIO

PERFECLITE PRODUCTS — THE MARK OF LIGHTING SERVICE

Fixtures are Underwriters Laboratories, Inc. approved

(*Continued from page* 18A)

DEFENSE COORDINATING — To contact various Government Agencies concerned with National Security suggesting cooperation and participation in specific projects as an aid to solution of their problems. Recommending the placement of lighting study projects in present committees or the appointment of study project committees to the Society President and to expedite such study projects and guide accepted reports into proper Government Channels.

J. W. Bateman, Co-Chairman, Canadian General Electric Co., Ltd., 212 King Street, W., Toronto, Ont.

A. F. Wakefield, Co-Chairman, The Wakefield Co., Vermilion, Ohio.

H. R. Blackwell — O. P. Cleaver
R. B. Brown, Jr. — John S. Walsh

HISTORICAL — To assemble and make available for current reference and to prepare in suitable and durable form for posterity, such historical facts, printed memorabilia, photographs, voice records, museum specimens and allied items as may be judged worthy of composing a continuing digest of the record of the Society's history.

S. G. Hibben, Chairman, 31 Clinton Ave., Montclair, N. J.

S. B. Williams, Vice-Chairman, Brooks Street, Jamestown, R. I.

J. L. Stair, Secretary, Harbert, Berrien County, Mich.

W. P. Bear — Leo Dolkart
R. B. Burton, Sr. — C. A. B. Halvorson
James Cravath — H. L. Logan
Julius Daniels — G. E. Stickney

LIGHTING SERVICE — To stimulate and promote the discussion and practical application of lighting recommendations and to conduct a Lighting Service Forum in connection with the National Technical Conference.

C. W. McCormick, Chairman, Connecticut Light & Power Co., P. O. Box 2010, Hartford, Conn.

Herb Anderson — Carter Lewis
Robert Babcock — L. E. Tayler
Walter Ball — J. Thomas
A. C. Brodeur, Jr. — Carlton Thompson
Berlon C. Cooper — C. E. Waldron

MEMBERSHIP — To develop plans and supervise the operation of the individual membership activity of the Society.

Brooks Chassaing, Chairman, Chassaing Brothers — Lighting, 7603 Forsythe Blvd., Clayton 5, Mo.

J. C. Forbes, Vice-Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Frank E. Brown, Jr. — Byron F. Lyth, Jr.
G. B. Buck, Jr. — Gerald Marks
Roy E. Dahlin — Glenn E. Park
E. I. Dinsmore — Blair Plowman
Ed Ehret — Joseph Thomas
J. M. Gensburger — Allen S. Turner

Task Subcommittee

Gerald Marks, Chairman, Lighting Associates, 53 W. Jackson Blvd., Chicago, Ill.

Roy E. Dahlin — A. S. Turner

NATIONAL TECHNICAL CONFERENCE — To be completely responsible, subject to the approval of Council, for the general coordination of all conference activities, for selecting and recommending time and place, for review of the plans and budgets of the National Technical Conference Executive Committee, and in cooperation with the Papers Committee for the satisfactory time allocation for the Technical Papers sessions, according to Procedures and Policies as adopted by Council.

C. L. Amick, Chairman, Day-Brite Lighting Inc., 5411 Bulwer Ave., St. Louis 7, Mo.

J. W. Bateman — J. D. Mitchell
J. B. Browder — A. C. Sangster
Brooks Chassaing — J. A. Schneller
H. F. Davidson — J. S. Schuchert
J. C. Forbes — C. C. Shotwell
W. P. Lowell, Jr. — Carlton M. Thompson
C. W. McCormick — John S. Walsh
J. Carl Wilson

1958 Conference Executive Committee

J. W. Bateman, Chairman, Canadian General Electric Co., Ltd., 212 King St., W., Toronto, Ont.

Task Subcommittee

A. C. Sangster, Chairman, Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

J. B. Browder — C. W. McCormick
H. F. Davidson — J. Dixon Mitchell
R. F. Hartenstein — Virginia Skinner
F. C. Winkler

PUBLIC RELATIONS AND INFORMATION — To prepare and disseminate information about the activities, accomplishments, programs, objectives and policies of the Society and about the place of illuminating engineering in modern society; to formulate and submit public relations policies and plans for the Society.

J. R. Chambers, Chairman, Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

W. A. Dalrymple, Vice-Chairman, Amalgamated Electric Corp., Ltd., 384 Pape Ave., Toronto, Ont.

Herb Cornell — John Ronayne
E. H. Gallet — C. C. Shotwell
T. W. Lauer — Joe Thomas
L. E. Tayler

REGIONAL ACTIVITIES — To represent the respective Regions before the Council and to keep the Council informed regarding the affairs of the Regions. To stimulate Society activities, to encourage joint meetings of Sections and Chapters including Regional Conferences within the respective Regions, and to promote the expansion of the Society.

J. B. Browder, Chairman, Georgia Power Co., 75 Marietta St. N. W., Atlanta 1, Ga.

James A. Banton — Joseph A. Schneller
A. Eugene Fleming — C. C. Shotwell
Reuben K. Lothrop — R. M. Taylor
George L. Morris — Carlton M. Thompson
Kenneth Reid — C. E. Waldron
J. Carl Wilson

RESIDENCE LIGHTING FORUMS — To stimulate and assist the Residence Lighting Forums of the Society and to encourage the formation of additional Forums. To conduct a Residence Lighting Forum in connection with the National Technical Conference.

Virginia Skinner, Chairman, Long Island Lighting Co., Old Country Road, Mineola, L. I., N. Y.

Clarence Cockrell — Rita Kuzell
William Downey — Ruth Lieb
Benjamin Duhov — Ruth Morris
Lillian Eddy — Elizabeth O'Kelley
Eve Freyer — Aileen Page
Lloyd Gabler — Jan Reynolds
Katherine Goodall — O. J. Scodock
Richard Graf — Marion Seitz
T. S. Kelly — J. Vernon Sharp

STUDENT MEMBERSHIP — To plan and implement a program to stimulate interest in Society activities and membership among college faculty and students; and to encourage the formation of student branches and assist in their operation and programs.

John O. Kraehenbuehl, Chairman, 10 Scott St., Broadmoor Park, Colorado Springs, Colo.

P. M. Alden — R. C. Paslay
M. E. Broom — Walter Sturrock

SUSTAINING MEMBERSHIP — To develop plans and supervise the operation of the Sustaining Membership activity in the Society according to the Procedures and Policies adopted by Council.

C. C. Keller, Chairman, The Holophane Co. Inc., 342 Madison Ave., New York 17, N. Y.

W. W. Booth — Fred Guth
Brooks Chassaing — C. C. Shotwell

TRUSTEES, I.E.S. HEADQUARTERS RETIREMENT PENSION PLAN

R. F. Hartenstein, Chairman, The Ohio Edison Co., Akron, Ohio.

J. R. Chambers — W. P. Lowell, Jr.
M. N. Waterman

TASK COMMITTEES

HEADQUARTERS LOCATION — To study all factors affecting choice of future location of Society Headquarters and to submit a recommendation to Council.

M. N. Waterman, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

D. M. Jones — L. E. Tayler
R. C. Paslay — John S. Walsh
J. D. Whitnell

I.E.S. - U. S. PUBLIC HEALTH SERVICE — To outline a method of making a survey of the visual factors of the working environment and the workers' vision and evaluating the findings in terms of visual comfort and effectiveness and eye health.

J. F. Parsons, Chairman, Niagara Mohawk Power Corp., Electric Bldg., Buffalo 3, N. Y.

Mrs. Tula Brocard — Henry N. Doyle
L. J. Cahill — Neal Jacobus
George Clayton — A. L. Koven
R. P. Teele

SIGN LIGHTING — To study the lighting of signs, both exterior and interior and report thereon.

C. N. Laupp, Chairman, Wisconsin Electric Power Co., 231 W. Michigan St., Milwaukee, Wis.

R. E. Faucett — A. L. Hart
H. B. Fletcher — W. H. Kahler
R. J. Neu

TECHNICAL COMMITTEES

AVIATION — To study the application of light and lighting to the spaces and functions involved in the operation of aircraft.

L. C. Simpson, Chairman, AGA Division, Elastic Stop Nut Corp. of America, P. O. Box 38, Elizabeth, N. J.

M. A. Warskow, Vice-Chairman, Port of N. Y. Authority, 111 Eighth Ave., New York 11, N. Y.

R. J. Stefany, Secretary-Treasurer, Westinghouse Electric Corp., Bloomfield, N. J.

J. F. Angier — W. D. Howell
F. C. Ashe — J. P. Hoxie
E. Boghosian — Warren Hulke
F. B. Brady — W. A. Jensen
F. C. Breckenridge — G. M. Kevern
W. D. Callaghan — W. E. Koneczny
P. B. Clark — A. L. Lewis
G. K. Clement — D. C. Miller
D. I. Coggins — J. K. Newell
H. A. Cramer — H. J. C.Pearson
C. A. Douglas — W. A. Pennow
Peter Downey — T. H. Projector
I. Fagin — F. C. Shipley
O. F. Farris — R. A. Stone
W. C. Fisher — L. C. Vipond
P. H. Greenlee — J. P. Wilson
J. S. Haney — A. B. Winters
L. W. Hornfeck — W. E. Woodson

Aircraft Cabin Lighting

W. E. Woodson, Chairman, Convair Division, General Dynamics Corp., Human Engrg. Group, P. O. Box 1950, San Diego 12, Calif.

R. K. Davis — A. J. MacIntyre
Edwin Ford — C. S. Milliken
Robert Hadzor — J. W. Tuttle
C. T. White

Aircraft Cockpit Lighting

T. O. Twist, Chairman, National Bureau of Standards, Washington 25, D. C.

(*Continued on page* 26A)

FIRST FROM JEFFERSON—— *ONLY* FROM JEFFERSON

NEW ONE CAN BALLASTS

FOR 4 FT., 6 FT. AND 8 FT. POWER GROOVE AND VHO LAMPS FOR COLD WEATHER OPERATION

New one can design saves up to 8 pounds per unit — or up to 12-11/16" length per unit over comparable 2 can ballasts.

YOU GET:

- less shipping weight
- smaller, more streamlined fixtures
- much easier assembly

		JEFFERSON Single can			COMPETITIVE 2 can or its equivalent	
LAMP	TEMP.	CAT. NO.	LENGTH	WEIGHT	LENGTH	WEIGHT
4′	0°	254-771	19 1/16"	17 lbs.	28 1/8"	25 lbs.
6′	−20°	254-781	25 1/16"	25 lbs.	38 1/8"	32 lbs.
8′	0°					

2 CAN BALLASTS FOR 6 AND 8 FT. LAMPS ARE AVAILABLE

Jefferson FLUORESCENT LAMP BALLASTS

JEFFERSON ELECTRIC COMPANY • BELLWOOD, ILL.

No Glare, No Eyestrain—a Pleasant Atmosphere Thanks to **LITECONTROL** *Low-Brightness Lighting*

Here's another installation which shows the eye-restful effectiveness of Litecontrol low-brightness illumination over a large area. You'll find the fixture that does this functional job (our No. 6044RS 2′ x 4′ troffer with Plexiglas dish diffuser) right in our catalog. It's *standard* — and the cost will appeal to any company or institution seeking good lighting at a sensibly budgeted investment.

The fixture is easy to clean and maintain also. Doors are easy to open by gentle fingertip pressure on "triggers" — and close simply by pushing back by hand. Doors also lift out if desired and may be installed to hinge from either side. No tools are needed.

Yes, Litecontrol can give you or your clients or customers excellent lighting with standard fixtures in *any* type of public building — bank, office, store, plant, school, library — whatever the job.

INSTALLATION: New Britain National Bank, West Main St. Branch, New Britain, Connecticut.

AREA: General Banking Area.

ARCHITECT: Jeter & Cook, Hartford, Connecticut.

ENGINEER: Henri Van Zelm Associates.

DESIGNER: Walter Heywood, West Hartford, Conn.

GENERAL CONTRACTOR: Frank Downes Construction Company, New Britain, Connecticut.

ELECTRICAL CONTRACTOR: Gunning Electric Company, Hartford, Connecticut.

FIXTURES: Litecontrol No. 6044RS 4-lamp recessed fixtures with Plexiglas dish.

INTENSITY: Average 75 foot-candles maintained.

LITECONTROL

Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION,

36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

You are cordially invited...

...TO PARTICIPATE IN THE

mmilj

COMPETITION TO SELECT

Your Most Interesting Lighting Job...

by submitting to your local IES Chapter
a presentation which may qualify you to compete
on the regional and national levels.

Prizes for the winning presentations in two Divisions include:

- **Name Inscribed on the Goddard MMILJ Trophy**
- **Silver Miniature of the Trophy as a Permanent Memento**
- **Descriptive Certificate**
- **Cash Award**

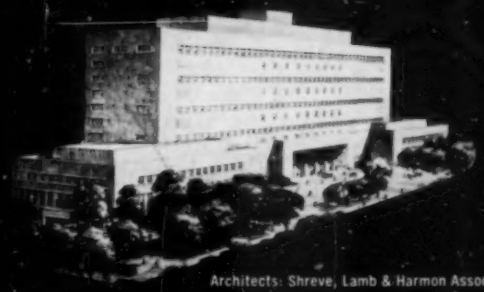
Appropriate awards also are made on the local and regional levels to winners.

Rules for this competition — available from your Section or Chapter Chairman — have purposely been kept simple because of the value which the Contest has to each and every member of the Society.

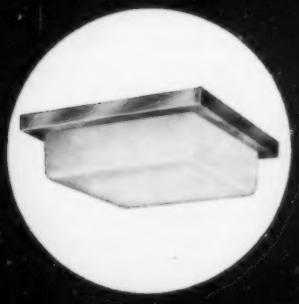
• ● •

Won't you join your friends and business associates in the profession in submitting an entry? Surely you, too, have . . . . **A Most Interesting Lighting Job.**

for the new Brooklyn Supreme Court Building



Architects: Shreve, Lamb & Harmon Associates
Electrical Contractor: John G. Hellman Co. Consulting Engineers: Syska & Hennessy, Inc.
N. Y. C. Commissioner of Public Works: Frederick H. Zurmuhlen



32-88 square ceiling unit for corridors . . . two 100 watt lamps.

37-65 new wall bracket for stairways and mirror lighting . . . two 15 watt fluorescents.

45E-8 directional sign for wall installation . . . one 8 watt fluorescent.

3½" shallow 43-24 recessed downlight for outside canopies, shower rooms, vestibules . . . one 150 watt lamp.

lighting design by mc Philben

The superb new Brooklyn Supreme Court Building features lighting by mc Philben throughout. From lobbies to boiler rooms, hallways to lavatories, auditoriums to prison cells, **special purpose** mc Philben units meet exact specifications.

Permanent satin finish . . . maintenance-free operation . . . durability . . . precisely engineered optics . . . these are some of the inherent advantages of mc Philben **cast aluminum** lighting units. For nearly half a century, mc Philben special purpose fixtures have contributed to the illumination and decor of America's most beautiful public buildings.

Your mc Philben representative will be happy to give you full details about these or other mc Philben special purpose lighting units. Consult him or send this coupon for individual specification sheets.

mc PHILBEN LIGHTING COMPANY
1329 Willoughby Avenue, Brooklyn 37, New York

mc Philben Lighting Co.
1329 Willoughby Ave., Brooklyn 37, N. Y.

Yes, send me individual specification sheets on the following lighting units:

43-24 ☐ 37-65 ☐ 45E-6 ☐ 32-88 ☐

Reserve a copy of your new catalog 58/1 for me ☐

Name_____

Company_____

Address_____

City_____ Zone____ State_____

(*Continued from page 20A*)

E. L. Ball — G. W. Godfrey
E. Bartley — W. L. Hitt
J. J. Fraizer — J. Lazo
J. W. Tuttle

Aircraft Exterior Lighting

R. A. Stone, Chairman, Airline Pilots Assn., 55th St. & Cicero Ave., Chicago 88, Ill.

O. Bakke — M. Karant
I. Fagin — G. M. Kevern
P. H. Greenlee — L. R. Noffsinger
W. D. Howell — T. H. Projector
W. A. Jensen — H. M. Schmies

Airport Runway Lighting

C. A. Douglas, Chairman, National Bureau of Standards, Washington 25, D. C.

G. K. Clement — G. M. Kevern
W. A. Darrah — L. C. Vipond
W. A. Jensen — M. A. Warskow

Airport Service Area Lighting

E. B. Karns, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland, Ohio.

R. H. Goodman — J. K. Newell
W. A. Jensen — H. A. VanDusen
M. A. Warskow

Airport Taxiway Lighting

L. C. Vipond, Chairman, Office of Airports, CAA, Washington 25, D. C.

G. K. Clement — J. E. Davis
V. E. Converso — R. L. Paugh
W. A. Darrah — E. G. Rudberg
H. A. Williams

Approach Lighting

O. F. Farris, Chairman, Office of Air Navigation Facilities, CAA, Washington 25, D. C.

J. F. Angier — D. I. Coggins
G. K. Clement — R. F. Gates
A. L. Lewis

Aviation Lamps (Large)

R. J. Stefany, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

E. Boghosian — O. F. Farris
F. E. Carlson — G. M. Kevern
D. I. Coggins — A. L. Lewis
L. C. Vipond

Aviation Lamps (Miniature)

M. A. Mortensen, Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

E. Boghosian — P. H. Greenlee
R. K. Davis — Norbert Schwenkler
W. C. Fisher — R. J. Stefany
I. Fagin — T. O. Twist
G. W. Godfrey — F. W. Wolfe

Bibliography

F. C. Ashe, Chairman, Kopp Glass, Inc., Swissvale, Pa.

T. E. Edwards — J. P. Hoxie

Definitions and Terms

J. F. Angier, Chairman, 14 Valley View Ave., Washington 12, D. C.

G. K. Clement — A. L. Lewis
I. Fagin — F. E. Shipley

Heliport Lighting

V. E. Converso, Chairman, Port of N. Y. Authority, 111 Eighth Ave., New York 11, N. Y.

J. S. Haney — H. Higgins
R. D. Hartz — E. G. Rudberg
L. C. Vipond

Papers

F. C. Breckenridge, Chairman, National Bureau of Standards, Washington 25, D. C.

J. F. Angier — H. J. C. Pearson

Seadrome Lighting

A. L. Lewis, Chairman, Bureau of Aeronautics, Dept. of the Navy, Washington 25, D. C.

R. C. Casperson — S. S. Knapp
W. W. Hulke — G. A. Rodney
J. E. Wesler

Liaison Committeemen

P. B. Clark — W. C. Fisher
T. M. Edwards — J. S. Haney

COLOR — To study, evaluate and report on the effect of color in relation to the art and science of illumination.

R. C. Allison, Chairman, Engineering and Design Dept., The T. Eaton Co. Ltd., Toronto 1, Ont.

W. E. Carswell — G. F. Dean

DAYLIGHTING — To study the problems involved in daylighting, develop recommended practices and report thereon.

H. B. Vincent, Chairman, Owens-Illinois Glass Co., Technical Center, 1700 N. Westwood Ave., Toledo, Ohio.

J. W. Griffith, Vice-Chairman, Southern Methodist University, Dept. of Engineering Research, Dallas, Texas.

W. J. Arner — H. F. Kingsbury
L. E. Barbrow — M. C. Kirkpatrick
R. A. Boyd — E. M. Linforth
R. L. Biesele, Jr. — W. F. Little
A. A. Brainerd — T. H. MacDonald
H. S. Bull — R. W. McKinley
E. W. Conover — E. C. Miles
Doyt Early — F. W. Mowrey
W. B. Ewing — R. H. Reed
C. D. Gibson — F. K. Sampson
B. F. Greene — Paul W. Seagers
J. S. Herbert — D. E. Spencer
G. N. Hingston — K. C. Welch
R. C. Kendall — O. F. Wenzler
C. J. Youngblood

Availability of Daylight (Exterior)

B. F. Greene, Chairman, 100 W. 42nd St., New York, N. Y.

R. A. Boyd — J. W. Griffith
H. F. Kingsbury

Brightness Ratio Measurement

J. W. Griffith, Chairman, Southern Methodist University, Dept. of Engineering Research, Dallas, Texas.

W. J. Arner — E. W. Conover
R. A. Boyd — E. C. Miles

Coordinating

R. A. Boyd, Chairman, Research Engineering Institute, University of Michigan, Ann Arbor, Mich.

E. M. Linforth — R. W. McKinley
D. E. Spencer

Revision of Recommended Practice for Daylighting

R. W. McKinley, Chairman, Pittsburgh Plate Glass Co., 1 Gateway Center, Pittsburgh 22, Pa.

W. J. Arner — R. C. Kendall
E. W. Conover — H. F. Kingsbury
W. B. Ewing — E. M. Linforth
B. F. Greene — T. H. MacDonald
R. M. Hanes — F. W. Mowrey
J. S. Herbert — C. J. Youngblood

DESIGN PRACTICE — To study published data on coefficients of utilization, room indexes, maintenance coefficients and other elements entering into calculations for lighting design; develop standard methods for use in Society publications and report thereon.

G. W. Clark, Chairman, Sylvania Electric Products Inc., Wheeling, W. Va.

Ward Harrison — H. A. Odle
J. J. Neidhart — E. H. Salter
Phelps Meaker — R. S. Wiseman

EDUCATION — To study and encourage lighting education and training for professional careers in schools, colleges and elsewhere; to prepare educational and training material on fundamental and advanced concepts of light and illumination, and to further its adoption in courses conducted by Sections and Chapters.

Alston Rodgers, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Robert Allen — R. R. Lusk
B. F. Avery — Gerald Marks
A. M. Bacalar — Roy A. Palmer
L. H. Brown — J. F. Parsons
O. P. Cleaver — R. C. Putnam
D. N. Finch — T. H. Shepherd
W. A. Hedrich — Wm. Weibel
P. H. Hildebrand — R. S. Wiseman
H. W. Horn — R. E. Wozniak
L. E. Innis — I. A. Yost
C. W. Zersen

ADVISORY MEMBERS

H. H. Magdsick — E. M. Strong

HANDBOOK REVISION—To revise and arrange the technical content of the Handbook; to lay out, plan and arrange for development of individual sections primarily through appropriate technical committees; to consult with the Publications Committee on its presentation of a suitable publication budget for Council approval; to be responsible to Council for the accuracy and treatment of material including the format and paging.

J. J. Neidhart, Chairman, The Miller Co., Meriden, Conn.

A. S. Almryde — W. H. Kahler
George Clark — R. W. Morris
Bruce Jensen — E. M. Strong

INDUSTRIAL — To initiate, follow up and coordinate lighting study projects in the industrial field, review the reports of the various subcommittees in this field and make recommendations to Council.

W. H. Kahler, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 1, Ohio.

L. G. Parks, Vice-Chairman, Ebasco Services, Inc., 2 Rector St., New York, N. Y.

Ed Balogh — E. A. Linsday
A. A. Brainerd — Howard Long
Richard E. Hars — D. J. O'Neill
Norman Kridel — Leo G. Stahlhut

Aircraft Manufacturing

J. G. Felton, Jr., Chairman, Sylvania Electric Products Inc., 100 Fordyce St., Dallas, Texas.

Robert S. Clubley

Clothing

Norman Kridel, Chairman, Rochester Gas & Electric Co., 89 East Ave., Rochester, N. Y.

Electronics Industry

R. S. Clubley, Chairman, General Electric Co., Large Lamp Dept., 2747 South Malt Ave., Los Angeles 22, Calif.

Graphic Arts

Ralph Enghouser, Chairman, Sylvania Electric Products Inc., 4700 Parkside Ave., Philadelphia, Pa.

Outdoor Production Areas —

Revision of Recommended Practice

E. A. Linsday, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Sawmills

James Barnes, Chairman, Pacific Gas & Electric Co., P. O. Box 540, San Rafael, Calif.

INSTITUTIONS — To initiate, follow up and coordinate lighting study projects in the field of public buildings and private institutions, review the reports of the various study subcommittees in this field and make recommendations to Council.

(*Continued on page 30A*)

LOWER LIGHTING COSTS

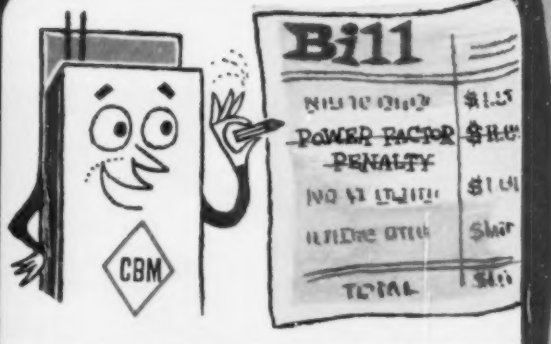
with fluorescent fixtures using

CERTIFIED CBM BALLASTS

UP TO 2500 HOURS MORE LAMP LIFE in fixtures using Certified CBM Ballasts. And rated light output, too. That's what tests by fluorescent lamp makers show.

TROUBLE-FREE SERVICE . . . for Certified CBM Ballasts provide assured ballast life . . . quiet operation . . . minimize replacements and repairs.

MADE TO EXACTING SPECIFICATIONS for performance by 8 leading ballast manufacturers, CBM Ballasts are checked and certified by ETL. And they're UL listed, also.



NO POWER FACTOR PENALTY on lighting bills because Certified CBM Ballasts are High Power Factor. (Saves on installation costs, too!)

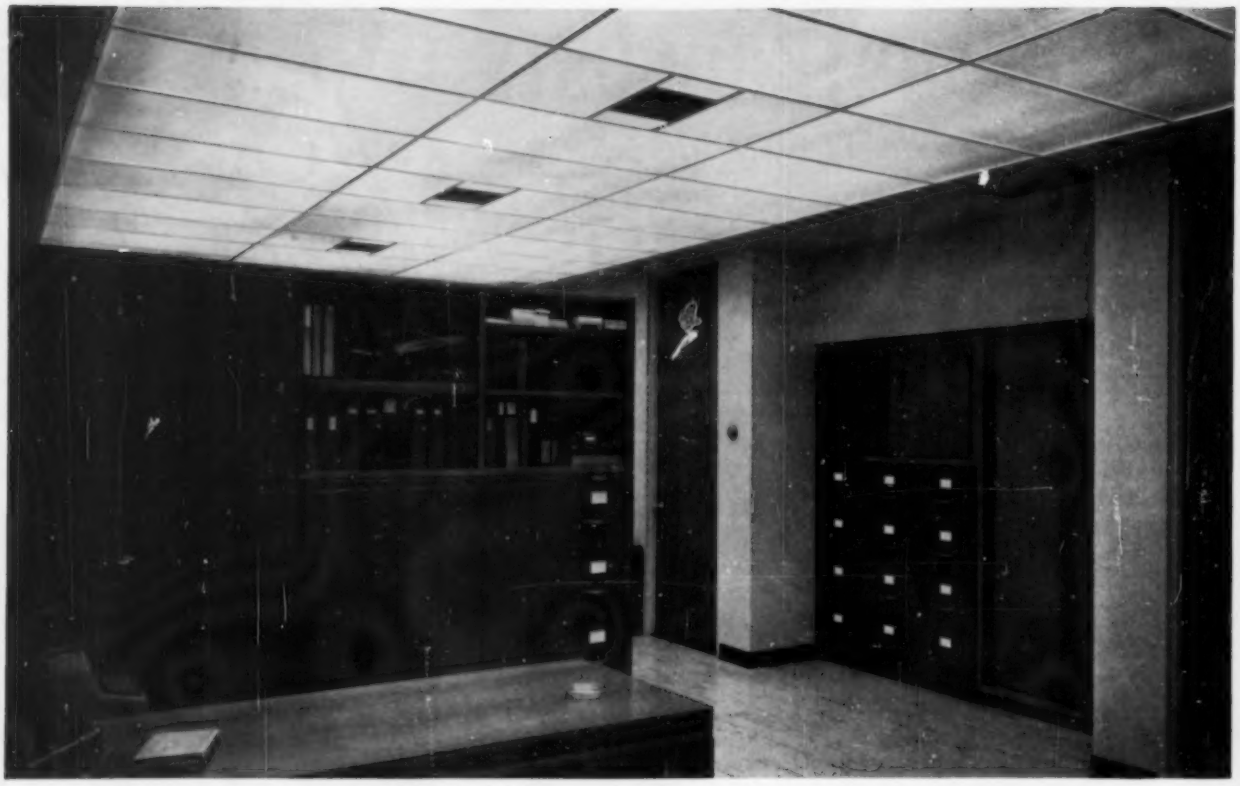
WRITE FOR FREE BOOKLET
"Why High Power Factor Ballasts cut your lighting costs"

Eight leading manufacturers now make up

CERTIFIED BALLAST MANUFACTURERS

2116 KEITH BUILDING • CLEVELAND 15, OHIO

Participation in CBM is open to any manufacturer who wishes to qualify



1. GENERAL OFFICE AREA in a new administration building makes extensive use of panels of Pattern No. 70 with luminous element. Illumination is glare-free and pleasing to the eye.

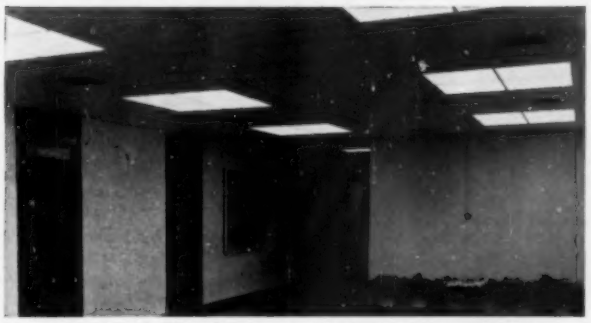
Only you would

2. LABORATORY gets the kind of low surface brightness required for close work with these suspended troffers. Main panels are Pattern No. 70; sides of Alba-Lite provide excellent diffusion. Suspended troffers also permit fitting lighting fixtures around needed venting apparatus.

3. CONFERENCE ROOM in recently erected building to house an advertising agency uses PYREX® lenslites mounted in free-form wood unit of custom design and fabrication.

4. FLUSH troffers using Pattern No. 70 bathe secretarial work area in soft, glare-free light. Ceiling mounts like this add to neat looks of office, minimize maintenance and cleaning problems.

5. FOTA-LITE provides subdued but highly efficient illumination for a top executive's office. This glass combines the advantages of smooth sheet glass with the control afforded by louvers.



6. GOOD LOOKS and adequate illumination are provided by these Square Alba-Lite Bowls mounted flush in lobby ceiling. Diffusing property of this glass obscures fluorescent elements.

7. END-TO-END troffers attached to ceiling have main panels of Pattern No. 70 with Alba-Lite side elements. This arrangement provides optimum light and service conditions for new office in a large printing establishment.

look UP in any of these 7 settings!

What's the best test of the effectiveness of any lighting system?

Quite probably it's the number of people who don't look up. The reason is simple: *When illumination is adequate, pleasant, unobtrusive, there's little reason to examine its source.*

Except, of course, from your standpoint.

And for *you* Corning makes the kind of lightingware that provides the *control* you need to achieve the *effects* you want.

From the situations pictured, you can get an idea of the variety of lighting problems that can be effectively handled with Corning glassware.

Extra value

You'll also find a number of important *bonus* values in lightingware by Corning. It looks good. It comes in many shapes and forms to fit into (*even add to*) every kind of décor and setting.

And your customers get the added advantages of lighting that's readily serviced, easy to keep clean and new-looking, rugged, and long-lasting.

Still more

Corning also makes special lightingware for use in maximum security situations and environments involving adverse conditions like wide temperature fluctuations.

At your fingertips

All the important details of what's available from Corning are summed up in "Commercial Lighting Application Guide." In it you'll find data on types of fixtures, varieties of glassware, suggested applications, in-use photos, and estimating tables. Free with the coupon.

Inquiries about specific problems, glasses and availabilities will receive prompt replies.

CORNING GLASS WORKS
61-12 Crystal Street, Corning, New York

Please send me a copy of "Commercial Lighting Application Guide."

Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....

Corning means research in Glass **CORNING GLASS WORKS,** 61-12 Crystal Street, Corning, N.Y.

(*Continued from page* 26A)

Leonard V. James, Chairman, 513 S. Catherine Ave., La Grange, Ill.

B. F. Avery — C. N. Laupp
J. H. McCulloch

Churches

George Shoemaker, Chairman, Philadelphia Electric Co., 211 S. Broad St., Philadelphia 5, Pa.

Anthony L. Bleecker — T. Norman Mansell
John E. Flynn — A. C. Sangster
Henrik W. Olsen

Dining Areas

Carl W. Zersen, Chairman, Chicago Lighting Institute, 140 S. Dearborn St., Chicago, Ill.

Albert Eiseman, Jr. — John L. Ranney
George Gilleard — E. L. Riego
C. T. Masterson — M. W. Ross
Raymond Wozniak

Hospitals

N. L. Griffin, Chairman, Dept. of Health, Education & Welfare, Public Health Service, Div. of Hospital & Medical Facilities, Washington 25, D. C.

H. W. Alexander — H. L. Logan
L. J. Buttolph — R. C. Putnam
E. H. Greppin — Paul Seagers
Howard Haynes — Howard Sharp

Hotels

C. I. Sayles, Chairman, School of Hotel Administration, Cornell University, Ithaca, N. Y.

C. L. Cottrell — J. Fassett
H. E. D'Andrade — Francis Keally
Myrtle Fahsbender — F. B. Mills

Museums and Art Galleries

J. M. Ketch, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

S. Eagleston — J. E. Flynn
Willard Thompson

LIGHT CONTROL AND EQUIPMENT DESIGN — Collect and correlate the knowledge and data on means and methods of controlling, directing, reflecting, transmitting and diffusing light and on the principles and practices of equipment design.

John T. McLaughlin, Chairman, Kelso-Burnett Electric Co., 223 W. Jackson Blvd., Chicago 6, Ill.

J. N. Robertson, Vice-Chairman, Los Angeles Dept. of Water and Power, Design and Construction Div., 405 S. Hill St., Los Angeles, Calif.

Milton Busan, Secretary, Day-Brite Lighting, Inc., 5411 Bulwer Ave., St. Louis, Mo.

G. R. Baumgartner — Maurice E. Robertson
Eric H. Church — William Weibel
Clarence Clarkson — F. C. Winkler
C. M. Holden — Paul Woodland

Plastics (IES-SPI-NEMA) —

LIGHT SOURCES — To correlate and report available information as to the physics of light and light production and the characteristics of current light sources.

George Freeman, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

Herbert Anderson — David Cutler
L. E. Barbrow — Grant Davidson
Keith H. Butler — R. B. Dull
W. P. Carpenter — Ernest H. Gallet
R. D. Churchill — Walter Houston
Frank Clark — E. F. Kelly
E. H. Salter

Color Rendition

Dorothy Nickerson, Chairman, 2039 New Hampshire Ave. N. W., Washington 9, D. C.

E. W. Beggs — Norman Macbeth
C. N. Clark — G. R. Stillwell
C. W. Jerome — Luke Thorington
D. B. Judd — Arthur Weeks
Gunter Wyszecki

MAINTENANCE — To study the elements contributing to maintenance factors; set up the framework of typical field studies to determine factors; and to stimulate the prosecution of such studies by appropriate agencies.

Francis Clark, Chairman, Lighting Services, 515 Meridan Rd., Waterbury, Conn.

Maxwell L. Trostle, Vice-Chairman, Sylvania Electric Products, Inc., Wheeling, W. Va.

R. D. Bradley — Howard Long
A. A. Brainerd — D. R. Philips
L. M. Endres — F. J. Roche
R. R. Enghouser — R. P. Teele
W. C. Fink, Jr. — W. C. Wagner
C. M. Holden — R. L. Zahour

MOTOR VEHICLE (EXTERIOR) — To study the problems of illuminating the night operations of motor vehicles and to make suitable recommendations for promoting maximum safety and convenience including accessory illuminated signal and traffic aids.

R. P. Teele, Chairman, National Bureau of Standards, Washington 25, D. C.

L. L. Beltz — D. M. Finch
P. J. Blinkilde — Burton Marsh
W. E. Carpenter — Charles Marsh
L. W. Chubb, Jr. — R. I. Nagel
Neil Dornstadter — Edmund Ricker
R. N. Falge — Val Roper
A. Rugo

NOMENCLATURE — To define the terms and standards of illumination, and endeavor to obtain uniformity in nomenclature.

Priscilla Presbrey, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

S. K. Guth, Vice-Chairman, General Electric Co., Nela Park, Cleveland, Ohio.

E. Q. Adams — D. M. Finch
Abraham Abramowitz — J. O. Kraehenbuehl
L. E. Barbrow — W. F. Little
George Clark — Phillip O'Brien
C. L. Cottrell — Harris Reinhardt

OFFICE — To study the lighting requirements of office lighting tasks, develop suitable lighting recommendations and report thereon.

G. F. Dean, Chairman, Toronto Hydro-Electric System, 14 Carlton St., Toronto, Ont.

A. S. Almryde — R. W. McKinley
C. L. Amick — J. J. Neidhart
C. T. Bakeman — G. G. Rae
Eric H. Church — T. H. Shepherd
L. M. Endres — R. T. Waite
W. S. Fisher — G. P. Wakefield
W. E. Folsom — R. R. Wylie
C. W. Macy — R. L. Zahour

PROGRESS — To keep in touch with developments in the art of lighting throughout the world and prepare a yearly review of achievements in the art of illuminating engineering for inclusion in ILLUMINATING ENGINEERING.

E. A. Linsday, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

R. C. Allison — Arthur R. Jaeger
H. A. Anderson — W. S. Kolb
E. W. Beggs — F. J. Marriett
L. R. Bush — J. H. McCulloch
J. T. Chambers — T. C. Sargent
R. E. Faucett — M. K. Strang
B. Goldberg — R. P. Teele
John Gornet — Maxwell L. Trostle
H. A. Williams

PUBLIC CONVEYANCES — Interior Lighting — To study the application of light to all public areas in conveyances used for passenger transportation, including particularly trains, buses, ships, street railways and subways, and report thereon.

E. Boghosian, Chairman, Dept of the Navy, Bureau of Ships, Code #560, Washington 25, D. C.

J. B. Feder, Vice-Chairman, U. S. Coast Guard, 1300 "E" St. N. W., Washington 25, D. C.

A. L. Arenberg — J. B. Spillane
C. E. Egeler — J. L. Swarner
E. B. Hallman — R. L. Sweeney
R. L. Henderson — R. M. Timmins
T. S. Madonia — A. Vandevelde
F. T. Snider — W. C. Wheeler

Interior Lighting — Land Transportation

J. L. Swarner, Chairman, Pullman Standard Car Mfg. Co., 10909 Cottage Grove Ave., Chicago, Ill.

A. L. Arenberg — C. B. Mackay
J. S. Bauer — T. S. Madonia
R. H. Bertsche — W. R. Preece, Jr.
E. B. Hallman — G. L. Sealey
R. L. Henderson — F. T. Snider
N. W. Henry — W. C. Wheeler
A. C. Zagotta

Marine Transportation

R. Timmins, Chairman, Gibbs & Cox, Inc., 21 West St., New York, N. Y.

W. M. Adrian — R. K. Johnson
E. Boghosian — R. Keuhne
J. B. Feder — T. S. Madonia
Frank Carlson — Lt. J. A. Moody
E. A. Geary — R. L. Sweeney
A. F. Vandevelde

QUALITY AND QUANTITY OF ILLUMINATION — RECOMMENDATIONS FOR — To prepare recommendations of illumination levels, brightness limits and brightness relationships in form applicable to practices.

B. S. Benson, Jr., Chairman, Benjamin Electric Mfg. Co., Des Plaines, Ill.

Willard Allphin — L. V. James
E. Boghosian — W. H. Kahler
J. M. Chorlton — Frank J. Marriett
G. F. Dean — Dana W. Rowten
Lester Geis — E. M. Strong
J. W. Griffith — Martin A. Warskow
S. K. Guth — W. W. Weld

RESIDENCE — To study and report on the application of light and lighting in residences; to develop performance recommendations for residence luminaires and to prepare necessary educational aids.

F. J. Marriett, Chairman, Thomas Industries, Inc., Moe Light Division, 700 Oak St., Ft. Atkinson, Wis.

W. F. Blitzer — E. A. Meehan
Henry Clum — L. Neuwirth
M. Fahsbender — Roy Palmer
Helen Gibbons — Jan Reynolds
A. R. Jaeger — R. V. Smith
Kaye Leighton — Mary B. Taepke
Norman Vacha

Measurement of Performance Characteristics of Portable Lamps

R. V. Smith, Chairman, Holophane Co,. Inc., 342 Madison Ave., New York 17, N. Y.

A. R. Jaeger — Priscilla Presbrey
Kaye Leighton — Jan Reynolds

Revision of Contemporary Lighting in Modern and Traditional Interiors

Myrtle Fahsbender, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

Kaye Leighton — Gladys Miller
Jan Reynolds

Training Outline

Mary B. Taepke, Chairman, Detroit Edison Co., 2000 Second Ave., Detroit 26, Mich.

Elizabeth A. Meehan

ROADWAY — To establish the scientific principles underlying street and highway lighting; to collect data on the results of the application of such principles to actual practice; to prepare such reports thereon as will assist technicians and benefit the public.

Dana W. Rowten, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 1, Ohio.

(*Continued on page* 32A)

HOW Westinghouse

JOB-TAILORED FLUORESCENT LAMPS MEET YOUR LIGHTING NEEDS

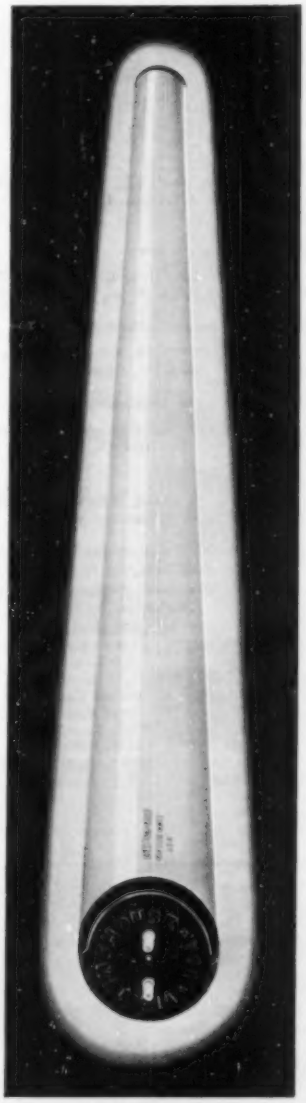
...all with ULTRALUME™ High-Intensity Phosphors • MORE LUMENS PER WATT... more light for your dollar • UNIFORM END-TO END LIGHT • PERFECT COLOR MATCH...ALWAYS • MAXIMUM OUTPUT MAINTAINED THROUGHOUT LONG LIFE

1. New SUPER-HI Fluorescent lamps produce more than twice the light per foot. Designed primarily for high bay (20 feet or higher) industrial and outdoor lighting, a new line of extra high light output fluorescent lamps produce more than twice as much light output per foot as standard fluorescent lamps. The new SUPER-HI lamps permit extremely high energy loading of electrodes, the arc stream and the phosphor. This gives you high light output with new economy at good efficiency and long life.

SUPER-HI lamps are light in weight, convenient to handle and provide a light source subject to the same easy optical control as with present standard T12 lamps, but with over twice the light output. Available in 105, 155, and 205 watts, 4, 6 and 8 ft. The lamps have a rated average useful life of 5000 hours, deliver 6000 to 13,000 initial lumens.

2. High Output Rapid Start lamps give more than 50% more light than regular type. Designed primarily for medium-high bay (15 to 20 feet) industrial and outdoor lighting, four new sizes of Westinghouse high output, rapid start fluorescent lamps can produce over 50% more light than comparable sizes of regular lamps and offer new economy and effectiveness to fluorescent lighting. These lamps provide increased lighting levels, make installations with adequate footcandle values of deluxe color light more practical, and improve the economy and practicability of fluorescent lighting at higher mountings and at lower ambient temperatures.

These lamps are available in 24", 48", 72" and 96" T12 design for general indoor use and for outdoor service where retention of light output at low temperatures is essential. The 72" T12 is recommended for street lighting.



3. Reflector-Fluorescent lamps produce 60% more directed light. For use where external reflectors are difficult or impractical to use, or where dirt deposit cuts lighting effectiveness, these Westinghouse Reflector-Fluorescent lamps provide a directional light distribution which helps put the light where you want it. This is accomplished by a built-in reflecting surface, extending the length of the lamp on the inside of the tube, which redirects about 60% extra light out the other side. Westinghouse Reflector-Fluorescent lamps are recommended for use in coves, showcases and other locations where space is limited. Indirect lighting effects may also be obtained by aiming the lamps toward the ceiling.

They also solve special lighting problems including temporary lighting for construction projects, displays, and exhibits.

Westinghouse Reflector-Fluorescent lamps are available in 40 watt rapid start, 48" and 96" T12 slimline types.

4. Beauty Tone™ Home-line Fluorescent lamps with warm white deluxe color. The same new Westinghouse "Beauty Tone Home-line" lamps which are revolutionizing home lighting by providing warm white deluxe illumination are also ideal for offices, stores and wherever "friendly" color of light is wanted to flatter complexion, enhance the natural color of furnishings, decorations, and displays, and blend well with incandescent lighting.

There's a network of Westinghouse distributors ready to serve you. Call your nearest Westinghouse Supplier for a free Job-Tailored Survey of your lighting requirements. Or write Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S Westinghouse

(*Continued from page* 30A)

Thomas J. Seburn, Vice-Chairman, Bureau of Highway Traffic, Strathcona Hall, Yale University, New Haven, Conn.

L. F. Heckman, Secretary, Union Metal Mfg. Co., 143 Maple Ave. N. E., Canton, Ohio.

*David M. Baldwin	C. R. Minors
R. P. Brotzman	F. E. Moesta, Jr.
P. C. Box	A. T. Nadeau
R. S. Bucher	*J. J. Oberhausen
*S. E. Cisco	O. P. Ortlieb
P. B. Clark	*H. W. Osborne
W. F. Crosby	*R. J. Palmer
W. H. Edman	*K. L. Partridge
W. B. Elmer	Ellis E. Paul
J. H. Fahey	*Blair E. Plowman
D. M. Finch	C. H. Rex
*H. A. Friede	F. J. Schmitt
G. K. Glass	*L. J. Schrenk
C. A. B. Halvorson	*J. Homer Shaw
*M. B. Hastings	*Edward L. Smith
W. E. Hawkins	R. M. Swetland
*R. M. Hoot	R. P. Teele
*Harry Hrivnatz	D. A. Toenjes
M. E. Keck	G. A. Trosper
G. E. Korten	H. E. Wall
*R. A. Landry	R. C. Wey
*Albert Lorch	A. B. Winters
*R. B. Marxheimer	Henry Wojcik
H. E. Mason	R. R. Wylie
J. F. McGough	J. W. Young

R. M. Zabel

*members only in advisory capacity.

Coordination

Frank J. Schmidt, Chairman, Rochester Gas & Electric Co., 89 East Ave., Rochester 4, N. Y.

General Light Sources

J. W. Young, Chairman, 47 Beacon St., Natick, Mass.

Handbook Revision

G. E. Korten, Chairman, Consumers Power Co., 212 W. Michigan Ave., Jackson, Mich.

Interchange with Foreign Groups

W. H. Edman, Chairman, Holophane Co. Inc., Newark, Ohio.

Lighting for High Speed, Heavy Traffic Density Highways

P. B. Clark, Chairman, Line Material Co., Milwaukee, Wis.

Parking Area Lighting

M. E. Keck, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 1, Ohio.

Photographic Studies

W. E. Hawkins, Chairman, Atlantic City Electric Co., Atlantic City, N. J.

Program and Publicity

F. E. Moesta, Jr., Chairman, Cleveland Electric Illuminating Co., Public Square, Cleveland 13, Ohio.

Research

D. A. Toenjes, Chairman, General Electric Co., Cleveland 12, Ohio.

Roadway Lighting Principles

Charles H. Rex, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

Standard Practices

W. H. Edman, Chairman, Holophane Co., Newark, Ohio.

Traffic Safety

O. P. Ortlieb, Chairman, 311 Municipal Bldg., Trenton 8, N. J.

Traffic Sign Lighting

A. T. Nadeau, Chairman, Room 251, City Hall, Los Angeles 12, Calif.

Tunnels and Underpasses

R. W. Swetland, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

Visibility Under Fog Conditions

Ellis E. Paul, Chairman, Howard Needles, Tammen & Bergendoff, 55 Liberty St., New York 5, N. Y.

SCHOOL — To study the application of light and lighting to the spaces and processes involved in educational institutions and to report thereon.

J. M. Chorlton, Chairman, Board of Education, 155 College St., Toronto 2B, Ont., Canada.

Carl Allen, Secretary, General Electric Co., Nela Park, Cleveland 12, Ohio.

Willard Allphin	J. L. Kilpatrick
R. L. Biesele, Jr.	C. N. Laupp
R. D. Bradley	H. L. Logan
L. H. Brown	J. D. MacConnell
H. F. Davidson	J. J. Neidhart
A. A. Eastman	J. F. Parsons
F. M. Foote	R. C. Putnam
W. V. C. Foulks	F. K. Sampson
R. L. Hamon	Paul Seagers
D. B. Harmon	E. M. Strong
R. C. Hultgren	H. A. Stroud
L. V. James	J. S. Walsh
Chester Jarrett	K. C. Welch

Chalkboards

H. F. Davidson, Chairman, Curtis Lighting of Canada Ltd., 195 Wicksteed, Leaside, Toronto, Ont.

Electric Lighting Design

J. F. Parsons, Chairman, Niagara-Mohawk Power Corp., Electric Bldg., Buffalo 3, N. Y.

Revision of School Handbook Section

Carl J. Allen, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Student Vision and Scholarship

A. A. Eastman, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Visual Problems

Paul Seagers, Chairman, School of Education, Indiana University, Bloomington, Ind.

SEARCHLIGHT — To study the design and application of searchlights and to report thereon.

J. P. Latil, Chairman, Genarco, Inc., 97-04 Sutphin Blvd., Jamaica 35, N. Y.

Stewart Belden	Arthur Hatch
Ernest Boghosian	Robert Heine-Geldern
F. E. Carlson	Charles A. Hern
Thomas W. Cushing	G. M. Kevern
Pierre Demoreuille	Harold Korbel
R. B. Dull	Peter Mole
C. E. Egeler	T. I. Monahan
R. E. Faucett	L. R. Noffsinger
B. R. Finch	W. A. Pennow
George Gerung	Don Peterson
C. J. Glass	B. Pritchard
D. S. Gustin	T. H. Projector
J. S. Haney	S. Resnick

Liaison Representatives

J. C. Boggs	B. Goldberg

Executive

Ernest Boghosian	W. A. Pennow
T. W. Cushing	T. H. Projector

Bibliography

J. P. Latil, Chairman, Genarco Inc., 97-04 Sutphin Blvd., Jamaica 35, N. Y.

Light Sources

R. E. Faucett, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

Stewart Belden	Arthur Hatch
F. E. Carlson	R. Heine-Geldern
George Gerung	Harold Korbel
M. A. Haskins	J. P. Latil

S. M. Segal

Nomenclature

E. Boghosian, Chairman, Bureau of Ships, Dept. of Navy, Washington 25, D. C.

T. W. Cushing	H. Korbel

Optics

Donald H. Petersen, Chairman, Bausch & Lomb Optical Co., Rochester 2, N. Y.

W. Drake	B. Goldberg
B. R. Finch	E. B. Heyer

A. W. Patteson

Revision of I.E.S. Handbook

T. H. Projector, Chairman, National Bureau of Standards, Washington 25, D. C.

E. Boghosian	A. E. Krawcek
Sidney Feldman	L. F. Noffsinger

S. M. Segal

Testing Procedures

T. H. Projector, Chairman, National Bureau of Standards, Washington 25, D. C.

Sidney Feldman	W. W. Lozier
George Gerung	S. M. Segal

R. S. Wiseman

Visibility of Sources

W. A. Pennow, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland 1, Ohio.

Visibility of Targets

L. F. Noffsinger, Chairman, Bureau of Aeronautics, U. S. Navy, Washington 25, D. C.

J. C. Boggs	H. C. Smith

SIGNAL LIGHTING, ELEMENTS OF — To compile a compendium of current information on all phases of signal lighting.

James F. Angier, Chairman, 14 Valley View Ave., Washington 12, D. C.

SPORTS AND RECREATIONAL AREAS — To develop current recommended practices for lighting sports and recreational areas; study techniques of application including effects on player performance and spectator visibility and report thereon.

Wallace W. Weld, Chairman, Revere Electrical Mfg. Co., 6009 Broadway, Chicago 40, Ill.

M. W. Ross, Secretary, Commonwealth Edison Co., 72 W. Adams St., Chicago 90, Ill.

James Bale	W. P. Graham
J. W. Bateman	Howard Long
Donald R. Brown	Edward Machtinger
R. H. Dickinson	John Mucha
R. T. Dorsey	D. E. Trefry
R. E. Faucett	H. M. White

STORE — To study the application of light and lighting to the spaces and processes involved in the selling of goods and to report thereon.

Lester Geis, Chairman, Garden City Plating & Mfg. Co., 23 W. 47th St., New York, N. Y.

Ted Ake	Richard Kelly
R. C. Allison	W. H. Kahler
D. P. Caverly	G. G. Rae
L. H. Dickelman	N. J. Sonnenfeld
R. T. Dorsey	K. C. Welch

Revision of Store Lighting Guide

R. T. Dorsey, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

Service Stations and Parking Areas

E. H. Schaefer, Chairman, Wisconsin Electric Power Co., 231 W. Michigan St., Milwaukee 3, Wis.

James Bale	H. A. Elwell
W. G. Barr	J. R. Fairweather
Fred Bahls	A. L. Hart
D. B. Brown	M. C. Harsh
C. M. Cutler	Frank Lago

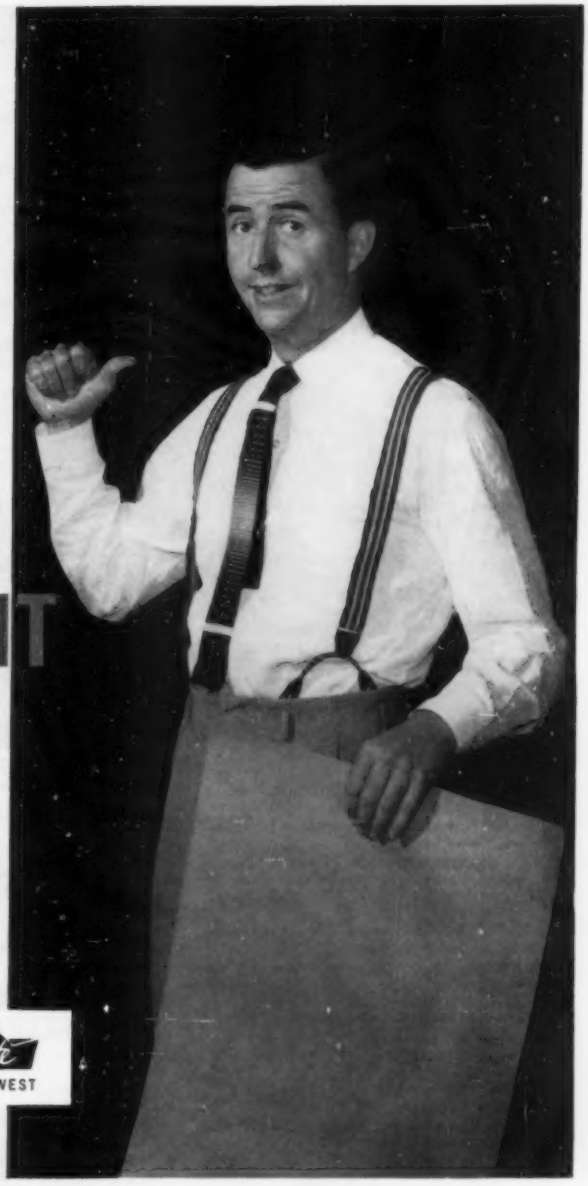
A. B. Winters

TECHNICAL COMMITTEE FORUM — To coordinate procedures of the technical committees of the Society.

G. J. Taylor, Chairman, Day-Brite Lighting, Inc., 161 E. 42nd St., New York, N. Y.

(*Continued on page* 34A)

"what? ... ME specify outdated high-bay lighting?"



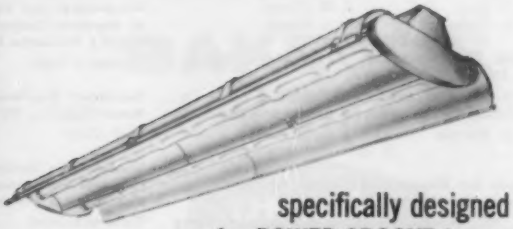
NOT ANY MORE! NEW ALL-BRITE PG FLUORESCENT DELIVERS MORE LIGHT AT LESS COST!

PG means fluorescent high-bay illumination, featuring **Power-Groove** lamps ... truly an industrial lighting milestone! Write for information.

All-Brite
LIGHT OF THE WEST

CONVAIR INSTALLS 3000 PG ALL-BRITE

Lighting Plan by Convair San Diego Plant #2. Electrical contractor, Chula Vista Electric Company.



specifically designed for **POWER-GROOVE** lamps

FLUORESCENT FIXTURES OF CALIFORNIA

352 SHAW ROAD
SOUTH SAN FRANCISCO, CALIF.

PLANTS ALSO IN LOS ANGELES; PORTLAND, OREGON; AND VANCOUVER, B. C., CANADA

(*Continued from page 32A*)

TESTING PROCEDURES FOR ILLUMINATION CHARACTERISTICS — To prepare standard test procedures for illumination characteristics of light sources, lighting equipment and illumination materials, and to report thereon.

Phelps Meaker, Chairman, General Electric Co., Nela Park, Cleveland 12, Ohio.

J. E. Bock	T. H. Leister
R. D. Bradley	J. H. McCulloch
Grant E. Davidson	George A. Meyers
D. M. Finch	F. M. Neal
J. S. Franklin	Priscilla Presbrey
W. G. Hill	D. W. Rowten
G. A. Horton	E. H. Salter
W. H. Houston	Ruland L. Smith
Paul Lamson	R. P. Teele
Bill F. Jones	Maxwell Trostle
A. E. Krawcek	A. W. Weeks
C. E. Leberknight	E. H. Witte

Peter L. Young

General Guide to Photometry

R. P. Teele, Chairman, National Bureau of Standards, Washington 25, D. C.

Guide for Brightness Measurements

Paul H. Lamson, Chairman, Smithcraft Lighting Division, 217 Everett, Chelsea 50, Mass.

R. D. Bradley	A. E. Krawcek
D. M. Finch	J. H. McCulloch
G. A. Horton	E. H. Salter
Bill F. Jones	R. P. Teele

E. H. Witte

Guide on Colorimetry

R. P. Teele, Chairman, National Bureau of Standards, Washington 25, D. C.

M. H. Gabriel	C. E. Leberknight
W. H. Houston	A. W. Weeks

Guide for Electrical Measurements of Fluorescent Lamps

George A. Meyers, Chairman, Sylvania Electric Products, Inc., 75 Sylvan St., Danvers, Mass.

Guide for Electrical Measurements of Mercury Vapor Lamps

J. S. Franklin, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

Guide for Life Performance Testing of Fluorescent Lamps

Priscilla Presbrey, Chairman, Westinghouse Electric Corp., Bloomfield, N. J.

Guide for Outdoor Illumination Tests

G. A. Horton, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland, Ohio.

Guide for Photometric Measurements of Mercury Vapor Lamps

J. S. Franklin, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

G. E. Davidson	Priscilla Presbrey
M. H. Gabriel	E. H. Salter
Mac Harris	A. W. Weeks
F. M. Neal	J. W. Young
J. H. Park	P. L. Young

Guide for Photometric Testing of Floodlights of 10-160° Beam Spread

J. S. Franklin, Chairman, General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C.

G. A. Horton	A. E. Krawcek

E. H. Witte

Guide for Photometric Testing of Fluorescent Lamps

A. W. Weeks, Chairman, Champion Lamp Works, 330 Lynnway, Lynn, Mass.

Guide for Photometric Testing of Fluorescent Luminaires

G. A. Horton, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland, Ohio.

R. D. Bradley	E. H. Salter
D. M. Finch	R. L. Smith
P. H. Lamson	Maxwell Trostle
F. M. Neal	E. H. Witte

Guide for Photometric Testing of Outdoor Fluorescent Luminaires

J. S. Franklin, Chairman, General Electric Co., Hendersonville, N. C.

Guide for Photometry of Searchlights

A. E. Krawcek, Chairman, Crouse-Hinds Co., Syracuse 1, N. Y.

Guide for Reporting Lighting Equipment Engineering Data

E. H. Witte, Chairman, Benjamin Electric Mfg. Co., Des Plaines, Ill.

R. D. Burnham	J. H. McCulloch

R. P. Teele

Guide for Use of Photoelectric Portable Photometers

G. A. Horton, Chairman, Westinghouse Electric Corp., 1216 W. 58th St., Cleveland, Ohio.

THEATER-TELEVISION — To study and report on the lighting for theatrical presentations and for production of television programs.

Joel E. Rubin, Chairman, Kliegl Bros., 321 W. 50th St., New York, N. Y.

Alfred W. Boylen	Herbert A. Kliegl
C. S. Bramley	Herbert More
T. W. Butler	Walter O'Meara
Ariel R. Davis	Kenneth M. Palius
Gilbert J. deStefano	Arthur C. Risser
D. W. Frick	Hunton D. Sellman
Theodore Fuchs	George C. Smedberg
Walter H. Garrett, Jr.	Rollo G. Williams
George T. Howard	Willett R. Wilson

Robert L. Zahour

OFFICIAL REPRESENTATIVES TO OTHER ORGANIZATIONS

AMERICAN STANDARDS ASSOCIATION SECTIONAL COMMITTEES

(C. L. Crouch, Technical Director, alternate representative to all.)

Building Exits Code, A9

H. E. D'Andrade

American Standard Practice for Industrial Lighting, A11

W. H. Kahler

American Standard Practice for School Lighting, A23

J. M. Chorlton

Building Code Requirements for Light and Ventilation, A53

J. W. Griffith

National Electrical Code, C1
Panel 2, 3 and 10

G. E. Shoemaker

Definitions of Electrical Terms, C42

Priscilla Presbrey

Dimensional and Operational Standardization of Electrical Lamps and Auxiliaries for Gaseous Discharge Lamps, C78

Thomas S. Kelly

Inspection Requirements for Motor Vehicles, D7.1

R. P. Teele

Standard for Motion Pictures, PH22
Sectional Committee PH2
Photographic Sensitometry

To be appointed

Office Standards, X2
Subcommittee 1, Office Equipment (furniture)
Subcommittee 2, Office Papers
Subcommittee 5, Business Machines

Roger Waite

Letter Symbols and Abbreviations for Science and Engineering, Y10

Priscilla Presbrey

Drawing and Drafting Room Practice, Y14

Priscilla Presbrey

Graphic Symbols and Abbreviations for Use on Drawings, Y32

Priscilla Presbrey

Preferred Numbers, Z17

J. R. Jones

Standardization in the Field of Photography, Z38

To be appointed

Safety Color Code, Z53

W. H. Kahler

Colors for Industrial Apparatus Equipment, Z55

W. H. Kahler

Standardization of Optics, Z58

Priscilla Presbrey

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, GOVERNING BOARD

S. K. Guth

ARMED SERVICES NRC VISION COMMITTEE

C. L. Crouch

INDUSTRY COMMITTEE IN CONNECTION WITH REVISION OF HANDBOOK OF INTERIOR WIRING DESIGN

A. C. Bredahl
G. E. Shoemaker

Handbook on Wiring for Small Commercial Occupancies

Willard E. Fichthorn

INSTITUTE OF TRAFFIC ENGINEERS
Joint Committee on Highway Lighting

To be appointed

INTER-SOCIETY COLOR COUNCIL

To be appointed

NATIONAL COMMITTEE ON UNIFORM TRAFFIC LAWS AND ORDINANCES

R. P. Teele

Vehicle Lighting

R. P. Teele
V. J. Roper, Alternate

NATIONAL OFFICE MANAGEMENT ASSOCIATION, Committee on Physical and Physiological Factors

To be appointed

NATIONAL RESEARCH COUNCIL
Division of Engineering and Industrial Research

R. P. Teele

National Academy of Sciences

A. F. Wakefield

Highway Research Board

Ellis E. Paul

SOCIETY OF MOTION PICTURE AND TELEVISION ENGINEERS

Joel E. Rubin

U. S. NATIONAL COMMITTEE OF THE INTERNATIONAL COMMISSION ON ILLUMINATION

A. A. Brainerd	H. H. Magdsick
C. L. Crouch	K. M. Reid
Glenn A. Fry	G. H. Stickney
W. P. Lowell, Jr.	E. M. Strong

M. N. Waterman

U. S. NATIONAL COMMITTEE OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

Walter C. Wagner

SCHOOL STAFF ENTHUSIASTIC! Shadow free light, the equivalent of soft daylight, achieved at low cost with translucent ceiling. (Min. 50 f.c. uniform intensity, max. brightness ratio under 3:1.) All structural members concealed. Nearly all rooms in the De Anza High School, El Sobrante, Calif., rely entirely on this lighting. Designed by John Carl Warnecke, AIA, "Acousti-Lux" panels and suspension system by The Celotex Corporation, Chicago, Ill.

With translucent ceiling...

This classroom needs no windows!

Night or day, cloudy or sunny, this classroom is evenly lighted. No problems of balancing daylight against illumination . . . no dark shadows—a more cheerful atmosphere . . . and figures indicate operating costs lower than many other systems!

Translucent ceilings with BAKELITE Brand Rigid Vinyl Sheet give complete control over lighting characteristics and help acoustically, too. They resist cracking, warping and discoloration . . . are normally unaffected by moisture and corrosive atmospheres. Lightweight BAKELITE Brand Rigid Vinyl Sheets also make ceilings easy to install, remove and maintain.

New designs . . . and renovations . . . look better and serve better when you use translucent ceilings with BAKELITE Brand Rigid Vinyl Sheet. For further information write Dept. BD-82.

BAKELITE
BRAND
PLASTICS

UNION CARBIDE

BAKELITE COMPANY, *Division of Union Carbide Corporation,* 30 East 42nd Street, New York 17, N. Y.

The terms BAKELITE and UNION CARBIDE are registered trade-marks of UCC.

why not try

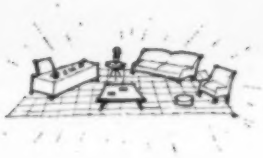
EXTRU-LITE® PATTERN

IN ACRYLIC (Plexiglas† and Lucite*) OR POLYSTYRENE

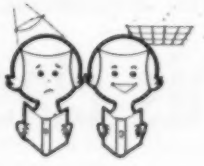
ITS LIGHTER THAN YOU THINK

. . . and that's the way it should be!

Like a room harmoniously decorated, where no one piece of decor strikes a discordant note, so fixtures using the new Extru-Lite Pattern R1, low brightness panel, supply light in abundance without drawing undue attention to its source.



With Extru-Lite Pattern R1, there is no distractingly bright glare, just an efficiently controlled light that surrounds you with a cheerful atmosphere.



R1 was purposely designed as a flat shield without a predominant direction, so that a high degree of visual comfort could be achieved without monotony by using any combination of 1′ x 2′, 1′ x 4′, 2′ x 2′, or 2′ x 4′ fixtures to create an interesting pattern of light. R1 gives one greater freedom in design layout.

Whether you are considering the development of your own exclusively created shield or are merely looking for a thoroughly competent supplier of "standard" type panels, you will find us ready to cooperate in confidence and to deliver as promised.

The Best Buy In Sight — Fixtures Using Extru-Lite

†Rohm & Haas Trade Mark
*DuPont Trade Mark

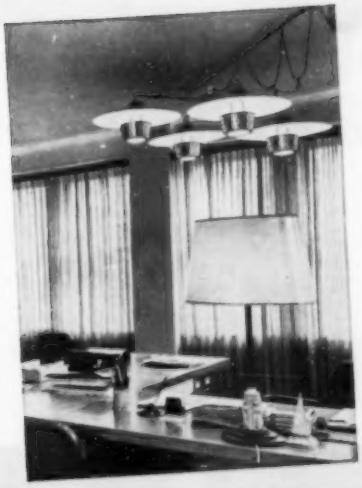
ROTUBA EXTRUDERS, INC.
418 88th STREET • BROOKLYN 9, NEW YORK
SHore Road 8-5458

Phila. Office
R. L. BOUSE
FLOURTOWN, PENNA.
Tel. CHestnut Hill 8-1010

CHICAGO Office
O'Connell & Associates
2514 W. Peterson Ave.
AMbassador 2-8841

CLEVELAND Office
Jannel Plastic Sales
5620 Broadway
VUlcan 3-7191

Makers of QUALITY PLASTIC EXTRUSIONS FOR INDUSTRY



Now *You* can sell the Beauty of

Custom Lighting

at standard fixture prices

Every store, *every* showroom, *every* restaurant, yes, even offices are top prospects for the Virden Wondabar! This wonderfully versatile kit lets you add the beauty and sales appeal of custom-made fixtures at only a fraction of their cost. And you sell the complete job, not just the installation.

For the Wondabar uses standard Virden fixtures. Lets you select from Virden's wide range of modern, contemporary, period and traditional designs to gain any decorative effect desired. Can be used with dimmer controls for even more dramatic effects. Installation is most economical, too, usually without rewiring or expensive remodeling.

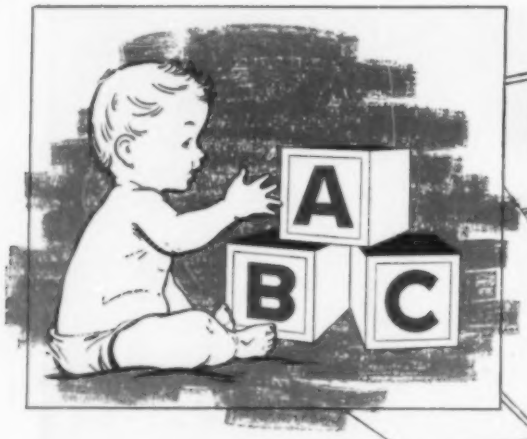
Wondabar kits are available in 3, 4 or 5 arm spreads in almost any length ceiling drop. See your Virden distributor. Look in the yellow pages of your phone book or write John C. Virden Co., 6103 Longfellow Avenue, Dept. IE, Cleveland 3, Ohio.

Wondabar

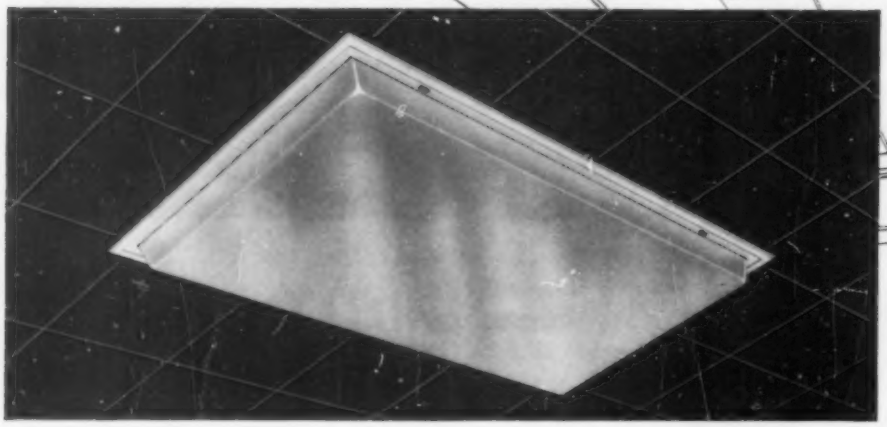
by **virden**

Member American Home Lighting Institute

VIRDEN Lighting



MODULAR UNITS
make the job simple!



3 BASIC MODULAR TYPES

A RECESSED AR-SERIES

Designed exclusively for recessed mounting and particularly adaptable for ceilings with low "head-room." A variety of closure styles provides complete application versatility. Each unit is wired ready to install—less lamps.

B THE SHALLOWLINE

Extremely shallow surface mounted modular units that give a built-in look, consistent with modern interiors. Units can accommodate varying numbers of lamps to achieve light intensities desired.

C AS-SERIES

Soon to be announced—a complete new line of shallow, surface mounted modular units, designed to accommodate different closures for complete versatility, efficiency and beauty.

PITTSBURGH'S NEW MODULAR LINE PROVIDES OVER 400 LIGHTING COMBINATIONS

These dimensionally accurate fluorescent modular units come in squares or rectangles for surface or shallow mounting. They can be used individually, continuously or at right angle combinations to form many pleasing light patterns. Attractively styled, they contribute to the beauty and efficiency of modern interiors.

And like all Pittsburgh Reflector equipment, these modular units offer the added advantages of high lighting efficiency and minimum maintenance. Their low cost makes it easy on the budget, too!

New comprehensive bulletins are available—Bulletin Z for recessed mounting and Bulletin O for shallow-surface mounting.

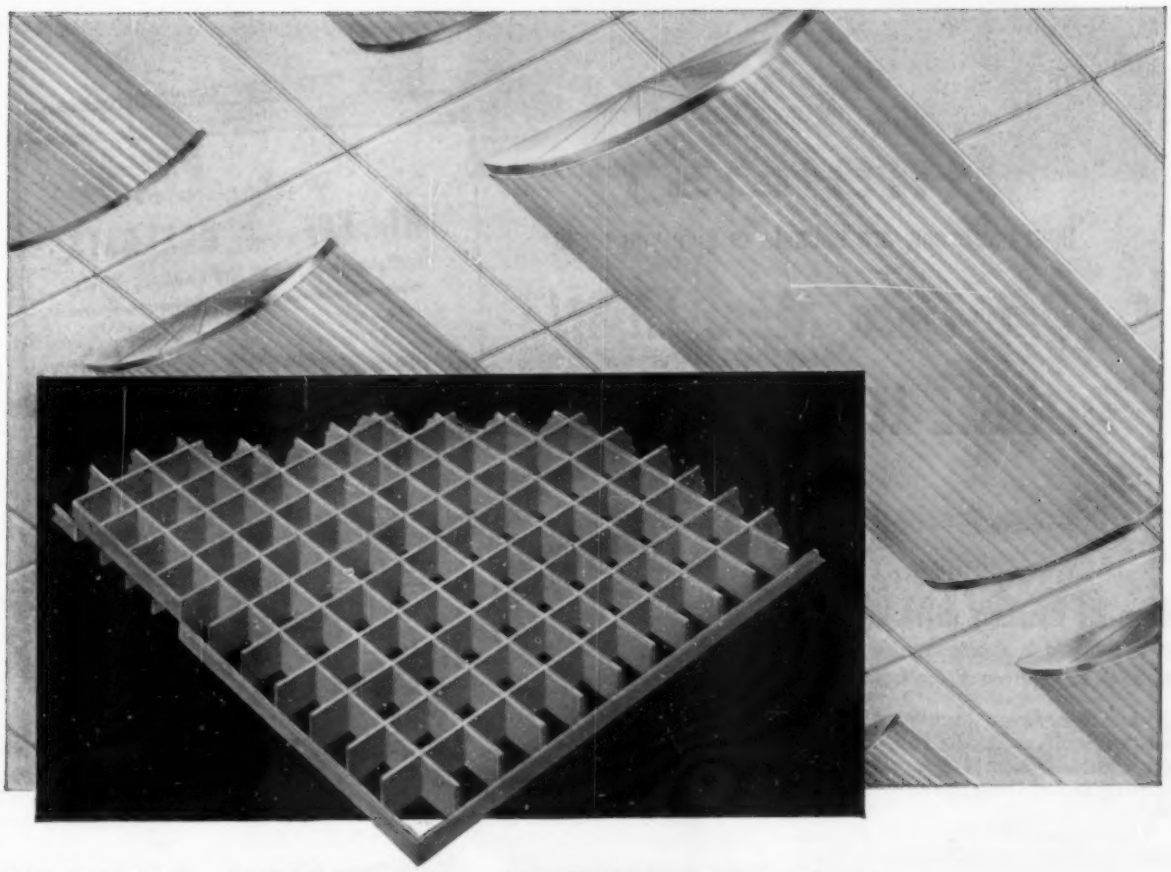
WRITE **FOR COPIES**

PITTSBURGH REFLECTOR COMPANY

411 Oliver Building, Pittsburgh 22, Pa.

Lighting Engineers in All Principal Cities of the United States and Canada

PITTSBURGH LIGHTING EQUIPMENT IS DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE



NEW FROM KOPPERS—

EVENGLO® light-stabilized polystyrene in COLORS

NOW YOU CAN SATISFY your customers' demand for colored lighting fixture components.

Koppers is offering new EVENGLO light-stabilized polystyrene in a wide variety of soft pastel shades. Lighting fixture grills, panels and shields can now have lasting, molded-in color to permit the desired hue, tone and soft tint in office, showroom and other commercial interiors.

This high quality, premium product meets Class C requirements of SPI-IES, "Proposed Property Specifications for Polystyrene Used in Fluorescent Luminaires." You can expect EVENGLO polystyrene to remain new and bright-looking far longer than any ordinary types.

Fadeometer and S-I sun lamp tests have proven the superior resistance of EVENGLO light-stabilized polystyrene to discoloration. Koppers application engineers will welcome your inquiries, and are ready to work with you. Write today for further information on the properties and light transmission characteristics of this interesting new EVENGLO polystyrene for lighting that is now supplied in pastel colors.

Koppers Company, Inc., Dept. 1E-127, Chemical Division, Pittsburgh 19, Pennsylvania.

Offices in Principal Cities • In Canada: Dominion Anilines and Chemicals Ltd., Toronto, Ontario

KOPPERS

KOPPERS PLASTICS

If your fluorescent lamp sizes are on

THIS LIST

then there now are ballasts to give you up to

One Third More Light!

DOUBLE-LONG LAMP LIFE!

Westinghouse

HIgh-EFFiciency BALLASTS

are co-ordinated to specific electrical requirements of each particular fluorescent lamp!

If your fluorescent lamps are on this list (at right) then you, too, can save *appreciable* amounts of money! — in lighting costs! — in prolonged lamp-life!

This is possible because *all* fluorescent lamps require ballasts *specifically suited* to *each* lamp's *own particular* operating characteristics!

Ballasts *unsuited* to given lamps can *reduce their light-output one-third!* — can *often* cut *lamp-life in half!* And the same is true of ballasts seemingly "matched" well enough — but not manufactured up to the standards necessary for those included in the Westinghouse HIgh-EFFiciency BALLAST list!

So, have your ballasts checked—at *the very first good opportunity!*—for *all three* of the following seals that distinguish *economical* ballast performance!

J-04421

Westinghouse

HIgh-EFFiciency BALLASTS

available now for all the following lamps:

LAMP TYPE	LAMP WATTS	CIRCUIT VOLTAGE
preheat		
40T12	1-40	118 v
40T12	2-40	118 v
40T12	2-40	277 v
40T12	3-40	118 v
90T17	2-90	118 v
90T17	2-90	265 v
90T17	4-90	265 v
rapid start		
40T12 rs	1-40	118 v
40T12 rs	1-40	265 v
series • 430 ma		
40T12 rs	2-40	118 v
40T12 rs	2-40	277 v
series • 800 ma		
48T12 rs	2-60	118 v
48T12 rs	2-60	277 v
96T12 rs	2-100	118 v
96T12 rs	2-100	265 v
slimline — 425 ma		
48T12	1-38	118 v
48T12	1-38	265 v
72T12	1-55	188 v
72T12	1-55	277 v
96T12	1-74	118 v
96T12	1-74	277 v
lead-lag		
48T12	2-38	118 v
48T12	2-38	277 v
72T12	2-55	118 v
72T12	2-55	265 v
96T12	2-74	118 v
96T12	2-74	265 v
series		
72T12	2-55	118 v
72T12	2-55	277 v
96T12	2-74	118 v
96T12	2-74	265 v

For special requirements not listed above, contact your nearest Westinghouse office, your own local Westinghouse Distributor, or write to Westinghouse Electric Corporation, Lighting Division, Edgewater Park, Cleveland, Ohio.

This Underwriters Laboratories Seal means that the ballast on which it appears is electrically *safe!*

This Certified Ballast Manufacturer's Seal means that the ballast meets rigid technical operating requirements.

This Westinghouse seal means that ballasts so identified *fulfill or exceed all CBM requirements!* — are warranted the distinction of inclusion on the Westinghouse HIgh EFFiciency BALLAST list — *yet cost no more* than ballasts that *may* be *wasting 1/3 your lighting potential! — that may be "killing" your lamps mid-way in their service life! Look* for the *Westinghouse* seal!

YOU CAN BE SURE...IF IT'S Westinghouse

BY ZEUS!

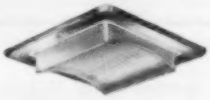
these Guth brascolite incandescent fixtures are TOPS!

SQUARE RECESS UNITS
with Holophane and Corning lenses for Intensive, Diffusing, Concave, Convex, Focusing and Asymmetrical distributions.

SILVER BOWL DIFFUSING fixtures in 4′ x 4′ and 2′ x 4′ sizes with the amazing GRATELITE Louver Diffuser*.

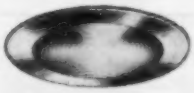
ALZAK PIN-HOLE RECESS LIGHTS
For intense downlighting—100 watt to 1000 watt sizes in General Service and Silver Bowl lamp types.

THE ROTATORS
Both EYEBALL (shown) and CONCEALED rotator. Adjustable recess downlites for PAR and R-lamps.



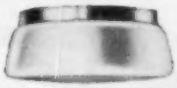
CORRIDOR PRISMATIC RECESS FIXTURES
Three types for 2½:1 and 1:1 ratios.

LONG BOY ELLIPSE
Surface luminaire
(also available in recess units). Gives narrow, high intensity beam for indoor or outdoor mounting, or for accent lighting.

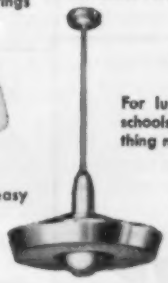


ROUND CONCAVE RECESS
Also available with Flat or Prismatic glass, and with metal concentric rings or open types.

BABY RECESS LIGHTS
For directional markers, night lights, other minimum intensity installations. Narrow beam or drop-lens types.



ALZAK HINGED GLASS Drum Units
Hinges on concealed chain for easy relamping and cleaning.



GRATELITE INDIRECT Pendant Type
For luminous indirect lighting in schools, stores and offices. Something new... and beautiful!

*GRATELITE Louver Diffuser® U. S. Pat. No. 2,745,001. Canadian Patented 1957, No. 538,245.

These and many, many more incandescent fixtures are included in this new Brascolite Catalog by Guth. A complete working tool, it contains all information needed to figure any incandescent lighting job.

Write on your letterhead for your complimentary copy.

THE EDWIN F. GUTH COMPANY
2615 Washington Blvd. • St. Louis 3, Mo.

Revere Outdoor Lighting Report

A timely discussion of an outdoor lighting problem and its solution, prepared for lighting engineers, lighting planners, and architects who may have similar outdoor lighting problems.

Lighting Chicago's "Auto World" Super Service Station

This unique new service station features an auto accessory store and "Speed-Kleen" car wash in addition to its regular auto services. The lighting installation had to be a "standout" to keep pace with this advanced station design.

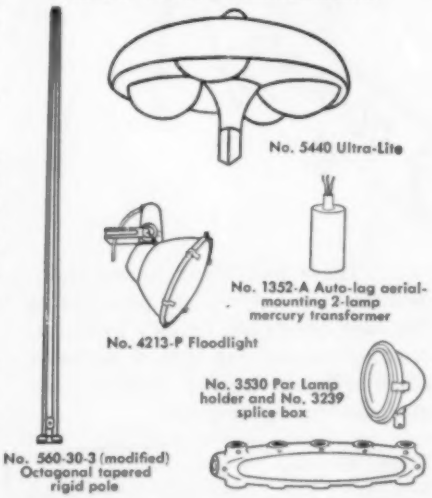
The Problem: To provide outstanding lighting for this unique super service station, so that it could compete favorably for night business with locations on the other three corners of this busy Chicago area intersection.

The Answer: Revere Ultra-Lites for service area lighting, with Revere floodlights for perimeter lighting.

Total service area of "Auto World" installation measures slightly under 10,000 square feet. Service area illumination is approximately 25 foot candles, average, with a ratio of about 2 to 1 overall. This level of illumination with its striking effect, was achieved with 9 Revere Ultra-Lites mounted on 24 foot standards. Perimeter lighting called for 4 standards, each standard mounting 3 Revere "4200" series floodlights. Clusters of 4 par lamp holders were mounted midway on three standards, beamed at the front of the building to emphasize functional detail.

The unusual degree of light uniformity at grade level is due to the pattern thrown by Ultra-Lites. Each Ultra-Lite luminaire is equipped with four 400-watt E-H1 mercury lamps. The controlled beam from the street lighting refractor produces a good shielding angle with high utilization and a square pattern of light.

Revere components used in "Auto World" installation


No. 5440 Ultra-Lite
No. 1352-A Auto-lag aerial-mounting 2-lamp mercury transformer
No. 4213-P Floodlight
No. 3530 Par Lamp holder and No. 3239 splice box
No. 560-30-3 (modified) Octagonal tapered rigid pole

This installation was planned by Revere lighting engineers, selecting the most appropriate lighting combination from Revere's wide group of outdoor lighting fixtures and fittings. No matter what the lighting problem — if it's outdoors, Revere has the equipment, or can engineer it, to provide your best lighting answer.

Revere ELECTRIC MFG. CO.

Write for catalog covering Revere's complete line of matched outdoor lighting equipment

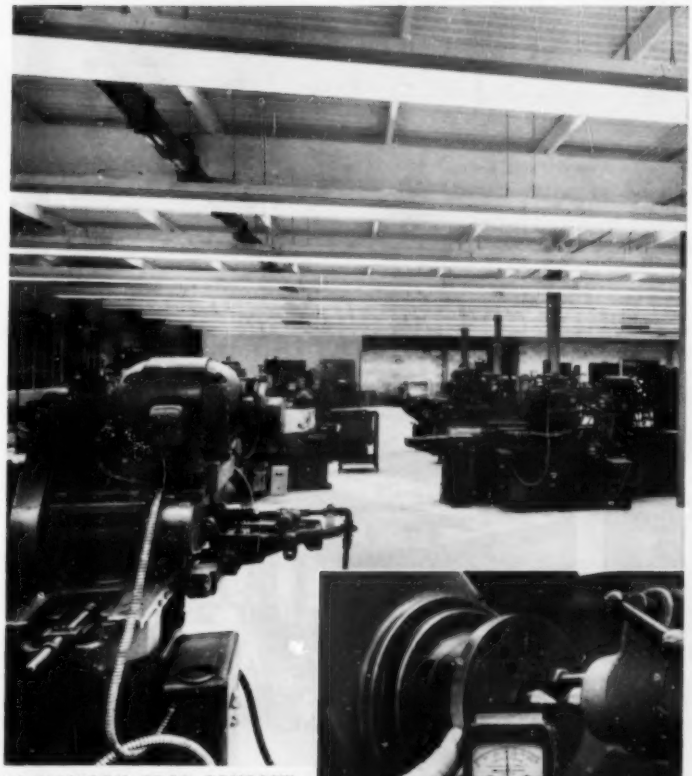
Revere Electric Mfg. Co., 6009 Broadway, Chicago 40, Ill., UPtown 8-7100

Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

OUTDOOR LIGHTING: Industrial • Commercial • Service Stations • Streets • Sports • Airports • Shopping Centers

The Powerful Power-Groove!

General Electric's radical new fluorescent lamp design can give you higher, more economical light levels



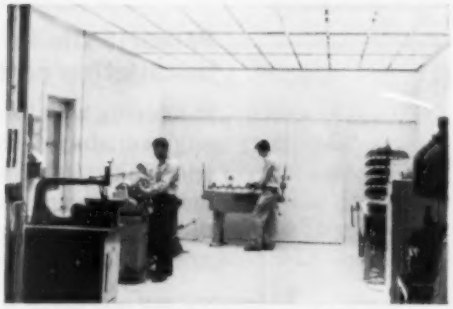
AT ERICKSON TOOL COMPANY (above), 450 G-E Power-Grooves, eight feet long, mounted 10 feet high, with 10 feet between rows, maintain a lighting level of 160 footcandles economically. This means there is plenty of light right at the machines (see footcandle reading at right)—where extra light means extra safety, extra accuracy for workers. No supplementary lighting is needed. Powerful Power-Grooves do it all!

While plans for their new building were still in the early stages, officers from Erickson Tool Company of Cleveland, Ohio, visited the Lighting Institute—General Electric's lamp headquarters at Nela Park. There they saw the whole array of lighting methods and discussed the powerful new G-E Power-Groove Lamps.

They were shown how these revolutionary lamps provide outstanding general lighting, making it unnecessary to use supplemental lighting on individual machines (like that used by Erickson toolmakers in their old plant). They saw how powerful Power-Grooves would fill a plant with pleasant light that's easy on the eyes . . . as well as the pocketbook. The decision was made: Erickson's new plant would have G-E Power-Groove Lamps throughout!

Because G-E Power-Groove Lamps give nearly twice as much light per tube as High-Outputs—2½ times as much as 8-foot slimlines—you can get more light per fixture—with fewer parts to maintain. And compared to other fluorescent systems, you can save 5-20% on your initial investment.

Get the whole exciting Power-Groove story. Write General Electric Co., Large Lamp Dept. IE-127, Nela Park, Cleveland 12, Ohio. Better still, visit Nela Park and let us show you on-the-spot demonstrations of how the powerful Power-Grooves can work for you . . . economically.



WORLD'S BRIGHTEST WORKSHOP—Now you can see powerful Power-Grooves in action . . . lighting the world's brightest workshop. It's at the G-E Lighting Institute at Nela Park. Plan to visit it and see for yourself.

Progress Is Our Most Important Product

GENERAL ELECTRIC

"a new tool for texture and parallelism"

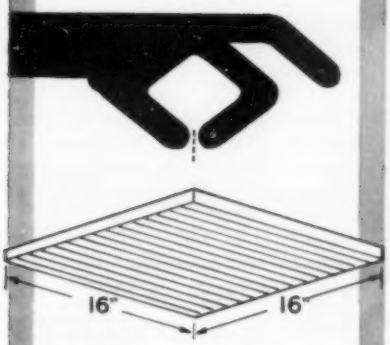
Paragrid tile for illuminated ceiling cuts installation costs 50% with Wilson 'U' TRAX suspension

In keeping with their leadership in the illuminated ceiling field, Wilson engineers have designed an entirely new illuminated ceiling tile combining specific desirable aesthetic qualities with a revolutionary suspension technique which cuts installation costs in half. PARAGRID Tile's amazing dispersement of light over the ceiling area now makes possible its use in areas with low ceilings in which illuminated ceilings were never before possible.

For full information regarding Paragrid Tile and our new installing techniques with "U" Trax suspension, write

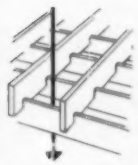
J. A. WILSON LIGHTING & DISPLAY INC.
516 G. Daniel Bladwin Bldg.,
Erie, Pa., Phone 21-1364.
(Formerly 260 Delaware Ave., Buffalo 2, N.Y.)

J. A. WILSON LIGHTING & DISPLAY LTD.
280 Lakeshore Road,
Toronto 14, Ontario. Phone CL. 1-3311.



Wilson
paragrid tile for illuminated ceilings with 'U' trax suspension saves 50% on installation

Paragrid Tile retains the contemporary "parallelism" of previous luminous ceilings but offers important advances in light diffusion, increased efficiency, easy handling and 50% savings on installation.



Bi-Planer construction gives exceptional diffusion plus even light distribution.

16" x 16" modules are easy to handle, easy to clean. Just dip in bath. Collect no bugs, no dust.

'U' Trax channel runs in one direction only. No cross members are required. Installation is fast—low cost.

Servicing is simple. Any one tile may be removed for maintenance of lighting, air-conditioning, plumbing, etc.

For full information write.

J. A. WILSON LIGHTING & DISPLAY INC.

Stocked and Distributed by Leading Distributors in the United States and Canada

(Continued from page 17A)

Officers of the Industrial and Commercial Lighting Equipment Section of the National Electrical Manufacturers Association, for the coming year, have been announced. They are: Chairman, **James F. Whitehead, Jr.,** Day-Brite Lighting, Inc., St. Louis, Mo.; Vice-Chairman, **Clarence C. Keller,** The Holophane Co., Inc., New York, N. Y. Mr. Whitehead has also been elected to the NEMA Board of Governors.

Sola Electric Co., Chicago, announces the appointment of **G. L. Bennis** as manager of their new branch office in San Francisco. Mr. Bennis, who was formerly assistant sales engineer in the company's Los Angeles office, will be located at the new branch at 1485 Bayshore Rd., San Francisco.

Daniel Rashall has joined Nu-Lite Fluorescent Mfg. Co., Los Angeles, to direct the company's marketing activities. Mr. Rashall was formerly national sales manager for the Sunbeam Lighting Co., and previously served as executive director for the Western Lighting Institute.

Benjamin Electric Mfg. Co., Des Plaines, Ill., has announced the appointment of **Dudley Moore** as district representative of their San Francisco office. Mr. Moore first joined Benjamin in 1953, and was recently on a short leave with a consulting engineering firm. Benjamin has also made an appointment in the Los Angeles office, where **Ray Bergman** of the Sacramento Branch has been transferred to assume the post of district representative. Mr. Bergman has been with the company for the past four years.

Robert E. Fromson has been named works manager of the Bryant Electric Co., Bridgeport, Conn., a wholly-owned subsidiary of Westinghouse Electric Corp. In his new position Mr. Fromson will be responsible for manufacturing, production and maintenance activities of the Bridgeport and Danielson, Conn., plants.

Appointment of five new salesmen in the Miniature Lamp Dept., General Electric Co., has been announced. The five new salesmen and their territories are: **Wallace E. Berth,** Midland Sales, Chicago, Ill.; **Elmer E. Garrison,** Dixie Sales, Atlanta, Ga.; **John Keefe, Jr.,** Atlantic Sales, New York, N. Y.; **Ralph J. Luft,** East Central Sales, Cincinnati, Ohio; and **James R. Schmidt,** West Central Sales, Kansas City, Mo.

Smoot-Holman Co., Inglewood, Calif., has named **C. D. Belt** and Co., Denver, as sales representative for Colorado, western Texas and New Mexico.

E. Allen Lea has been appointed Sales Manager of the Lighting Division of Thomas Industries Inc., Louisville, Ky. Mr. Lea joined the company in 1947 and has, most recently, been acting as Assistant Sales Manager. His duties will include Moe Light, Star Light and Radiant Glass.

The appointment of **L. H. Dupont, Jr.** and **Arthur Wachter,** of Dupont-Wachter & Co., as sales representative for Curtis Lighting, Inc., has been announced. The agency, which was formed in 1952 has its office at 609 Tohoupitoulas St., New Orleans, La.

Walter B. Gesell has been appointed Director of Economics of the Edison Electric Institute. Mr. Gesell is retiring as Vice-President in Charge of Operations for the Oklahoma Gas and Electric Co., and has accepted the E.E.I. appointment on a short-term basis to head the newly established Economics Dept.

Piolite Division, Pioneer Plastics, Inc., of Salem, Mass., announces the acquisition of a West Coast warehouse at 1025 North Highland Ave., Los Angeles, Calif.

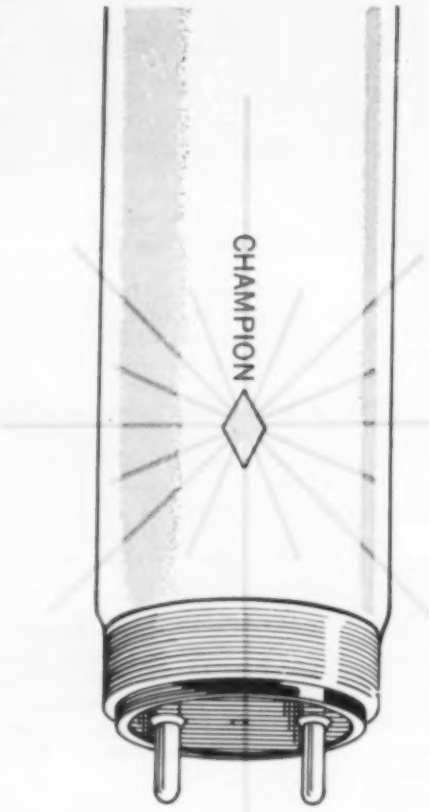
Jay G. Gates has been appointed representative for Kuhlman Electric Co., Birmingham, Mich., in the southwestern Ohio

(Continued on page 46A)

For Next Year's Conference Papers

Deadline for outlines of next year's conference papers is December 31, 1957. The earlier date (August 17-22, 1958) of the National Technical Conference next year has necessitated an earlier deadline for Papers Committee consideration of proposed papers. Those wishing to present papers before the 1958 conference in Toronto should submit outlines not later than December 31, 1957 to:

H. F. Davidson, Chairman, Papers Committee, I.E.S.
Curtis Lighting of Canada, Ltd.
195 Wicksteed Ave.
Leaside, Toronto 17, Ont.



full of life

thanks to **CHAMPION LIGHTMANSHIP**

OVER 200 INSPECTIONS—just one example of how Champion applies LIGHTmanship to make sure you get all the light you pay for. Checks and counter checks at every step of production guard you against early burn-outs and early dim-outs when you use Champion lamps.

CHAMPION Lamps

CHAMPION LAMP WORKS
LYNN, MASSACHUSETTS
A Division of Consolidated Electric Lamp Co.

MILLIONS OF LAMPS A YEAR . . .
ONE PLANT Standard of Quality Control

(*Continued from page 45A*)

and Kentucky territory. Mr. Gates formerly headed the company's Southern Division Sales.

Thomas A. Bissell has been appointed Executive Secretary of the Society of Plastics Engineers. Mr. Bissell was formerly a staff member of the Society of Automotive Engineers.

BOOKS AND PAMPHLETS

Fasteners Handbook, by Julius Soled, published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y., 1957, 430 pages illustrated and indexed. $12.50.

The author has intended that this book will fill the need for specific information about many types of currently available fasteners. There are sections on: rivets; inserts; screws, bolts, studs; nuts; washers; retaining rings; pins; nails; metal stitching; quick release fasteners; masonry anchoring devices; and hose clamps. Each fastener is illustrated and described with additional information on its features, uses, standard materials, standard sizes, and manufacturers. A manufacturers directory is included along with an index for convenience.

In conjunction with his work as design engineer for the Signal Corps Engineering Laboratories, the author, a Professional Engineer, has written several articles for scientific and engineering journals.

Outdoor Lighting Souvenir Folders. A limited number of historical souvenir folders containing color reproduction of early outdoor lighting installations are available on request from General Electrics Outdoor Lighting Dept.

There are two types of folders. One contains 27 color reproductions of spectacular lighting installations at the 1915 "Panama Pacific International Exposition" at San Francisco; the other, containing 15 reproductions, is a record of lighting at the 1934 "Century of Progress Exposition" at Chicago.

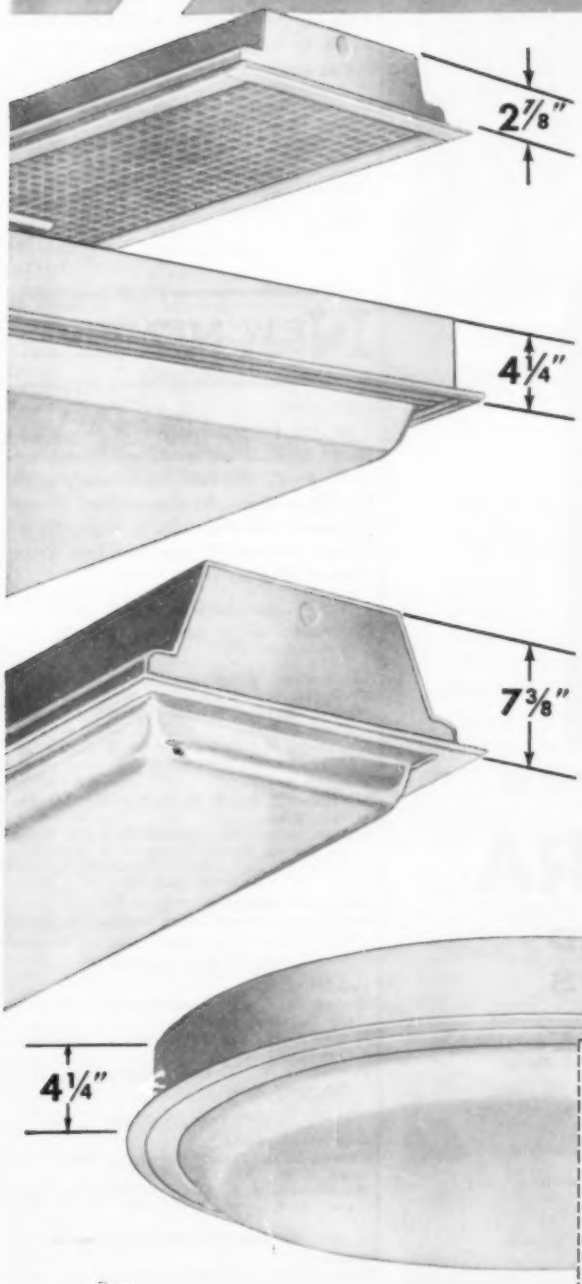
The folders are available on a first-come-first-served basis from R. E. Faucett, senior application engineer, Outdoor Lighting Dept., General Electric Co., Hendersonville, N. C.

High Frequency High Voltage Fluorescent Lighting, available from The Wakefield Co., Vermilion, Ohio, and Wakefield Lighting Ltd., London, Ont. No charge.

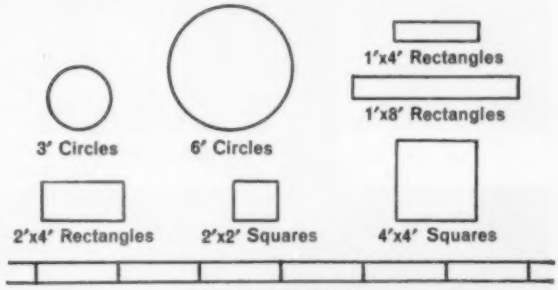
Four papers from ILLUMINATING ENGINEERING, July 1957 are reproduced in this

(*Continued on page 48A*)

Troffers of ALL Types by LPI



MAXIMUM CEILING ADAPTABILITY



Widest possible range of shapes and forms . . . making possible unlimited patterns and combinations.

Widest possible choice of diffusers . . . polystyrene louvers . . . plain formed acrylic . . . corning low brightness . . . curved corning lens . . . curved alba-lite . . . corning twinlens . . . flat alba-lite . . . metal louver . . . pattern formed acrylic . . . pattern formed vinyl.

Space variations . . . 2⅞" "Thin," where ceiling economy is critical . . . 4¼" "Shallow," when limited space is available . . . 7⅜" deep, when normal recessing depth is possible.

Workmanship . . . highest possible quality material, formed and assembled under unmatched inspection standards by top skilled craftsmen.

Sensible pricing . . . if quality luminaires could be produced and sold for less, LPI would be the one to do it.

MAIL THIS COUPON TODAY

Don't just take our word for it! Convince yourself that LPI has the widest, most complete line of TROFFERS. There is an LPI TROFFER-combination to solve any problem concerned with *esthetics, space, light control and distribution, construction quality or sensible price.*

LIGHTING PRODUCTS INC. Dept. 6P Highland Park, Illinois

Please send detailed information on LPI's complete line of Troffers.

Name_____ Title_____

Firm_____

Address_____

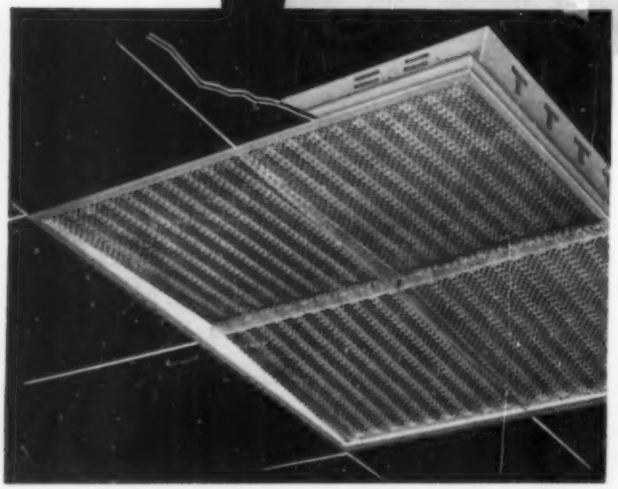
City_____ Zone_____ State_____

no light leaks

new extruded aluminum

light-tight

trim and frame



one of many new engineering features

in new **AURORA**

RECESSED TROFFERS

- *New shallower design*
- *New plastic, glass & metal shieldings*... glass to glass in continuous run*
- *Safe low temperature operation*
- *Standard one foot widths plus 2 x 2, 2 x 4, 4 x 4*

**Holophane lens distributor*

metco Lighting

sold only through qualified electrical distributors

METALCRAFT PRODUCTS CO., INC., MASCHER & LIPPINCOTT STS., PHILADELPHIA 33, PA.

(Continued from page 46A)

booklet on the theory, generation and application of high frequency, high voltage current in lighting. Authors are J. H. Campbell, Q. D. Dobras, Shelley Krasnow and R. H. Horner.

Also included is a catalogue of the company's lighting equipment suitable for 400-600 volt, 840 cycle operation.

The Science of Decorating Schools, available from National Chemical & Manufacturing Co., 3617 South May St., Chicago 9, Ill. 24 pages. No charge.

This booklet is in the main a reprint from the June-July 1956 issue of *School Planning Magazine*, and includes the following articles:

Classroom Hazards to Health and Learning, by John Marshall Ziv.
Perception of Size and Space Altered by Brightness, Color, by Samuel Renshaw
Key to Classroom Color Combinations
Color and Learning in the Co-Ordinated School, by D. B. Harmon, J. M. Ziv and Thomas P. Moran

NEW MEMBERS

At the recommendation of the I.E.S. Board of Examiners, at their November 14 meeting, the following were elected to membership. Names marked * are transfers from Associate Member Grade. Names marked ** are transfers from Student Member Grade.

ALABAMA SECTION

Krahenbuhl, Pat, Canterbury Electric Co., Birmingham, Ala.

ALAMO SECTION

Members:
*Cotton, K. L., General Electric Co., San Antonio, Texas.
Kindel, L. H., Central Power & Light Co. Corpus Christi, Texas.

Associate Members:
Billingsley, J. B., H. B. Zachry Co., San Antonio, Texas.
Wallace, A. C., Jr., Central Power & Light Co., Corpus Christi, Texas.

ARIZONA SECTION

Associate Member:
Geis, T. A., Arizona Public Service Co., Phoenix, Ariz.

ARK-LA-TEX CHAPTER

Associate Members:
Hanson, H. J., Jr., Southwestern Gas & Electric Co., Shreveport, La.
Jorden, J. C., Jr., Neild Somdal Associates, Shreveport, La.
Thomas, J. W., Graybar Electric Co., Inc., Shreveport, La.

BLUENOSE CHAPTER

Associate Members:
Penney, E. R., Penney Enterprises Reg., Halifax, N. S.
Wigglesworth, A. F., Town of Liverpool, Liverpool, N. S.

BRITISH COLUMBIA SECTION

Member:
Baker, J. E., Vancouver Lighting Co. Ltd., Vancouver, B. C.

CAPITAL SECTION

Associate Members:

Barnhart, H. J., Westinghouse Electric Supply Co., Washington, D. C.

Burkhalter, E. E., District of Columbia Government, Washington, D. C.

Garner, J. W., District of Columbia Government, Washington, D. C.

Herring, E. D., District of Columbia Government, Washington, D. C.

CENTRAL NEW YORK SECTION

Associate Members:

Passage, R. W., Graybar Electric Co., Inc., Syracuse, N. Y.

Rotunno, W. A., Sylvania Electric Products Inc., Syracuse, N. Y.

CENTRAL OKLAHOMA CHAPTER

Associate Member:

Colquitt, L. J., Electric Supply of Oklahoma, Oklahoma City, Okla.

CHICAGO SECTION

Members:

Brooks, W. W., General Electric Co., Danville, Ill.

Freegard, E. M., General Electric Co., Danville, Ill.

Geyer, R. C., Commonwealth Edison Co., Chicago, Ill.

Lovinger, Daniel, General Electric Co., Danville, Ill.

St. Pierre, H. H., Public Service Division, Commonwealth Edison Co., Kankakee, Ill.

*Wienick, P. P., Modern Light & Equipment, Chicago, Ill.

Associate Members:

Abrahams, F. W., Advance Transformer Co., Chicago, Ill.

Dowds, C. V., Curtis Lighting, Inc., Chicago, Ill.

Gedzun, W. J., Joslyn Mfg. & Supply Co., Chicago, Ill.

Hausmann, Siegfried, Benjamin Electric Mfg. Co., Des Plaines, Ill.

Hedstrom, V. J., Public Service Division, Commonwealth Edison Co., Maywood, Ill.

Scharnagl, W. E., General Electric Co., Chicago, Ill.

Wells, B. A., General Electric Co., Chicago, Ill.

Williams, J. H., Benjamin Electric Mfg. Co., Des Plaines, Ill.

CHINOOK CHAPTER

Member:

Inch, D. S., Bancroft & Inch, Calgary, Alta.

CLEVELAND SECTION

Members:

*Conrad, T. T., Dalton-Dalton Associates, Cleveland, Ohio.

Dean, R. W., Furbay Electric Supply Co., Canton, Ohio.

*Terkel, M. W., The NL Corp., Cleveland, Ohio.

Associate Members:

Gaetjens, A. K., General Electric Co., Cleveland, Ohio.

Jenkins, W. A., Westinghouse Electric Corp., Cleveland, Ohio.

Meyer, N. F., General Electric Co., Cleveland, Ohio.

CONNECTICUT SECTION

Associate Members:

Hesse, R. J., Sola Electric Co., Chicago, Ill.

Moody, J. A., Naval Medical Research Laboratory, Submarine Base, New London, Conn.

CORNHUSKER SECTION

Associate Members:

Failla, Victor, Leo A. Daly Co., Omaha, Neb.

Garcia, J. T., Consumers Public Power District, Lincoln, Neb.

Scott, R. W., John Latenser & Sons, Omaha, Neb.

Stone, T. C., Hoskins & Associates, Lincoln, Neb.

FLORIDA SECTION

Associate Members:

Minton, R. R., Bishop & Johnson, Inc., Tampa, Fla.

Plocar, G. E., Raybro Electric Supplies, Inc., Tampa, Fla.

(Continued on page 50A)

ULTRA VIOLET TEST: Pigment in FROST-WHITE* shield on right fluoresces, shows complete penetration of ultra violet light. Light stable, ultra violet-absorbent coating on new FROST-WHITE-X shield at left cuts out such light, thus prevents premature discoloration.

NOW – SHEFFIELD SHIELDS THAT DEFY BREAKAGE, ARE LIGHT STABLE AND REFLECTION-FREE

Another "first" from Sheffield Plastics!!

You can now obtain plastic shields for fluorescent fixtures that minimize breakage in shipping and handling, eliminate eye-strain from surface reflections and are light stable up to 50,000 lighting hours!!

Sheffield's new FROST-WHITE-X** polystyrene shields are extremely flexible, can be dropped or twisted without damage. They have a matte finish which prevents stray light reflections. And a special ultra violet absorber permanently incorporated on the plastic prevents premature discoloration.

Applied to the panel surface nearest the light source, the absorbent provides maximum protection without danger of long term degradation or embrittlement of the polystyrene.

These are the first styrene shields to combine all these features. They open new design possibilities, cut replacement costs, simplify handling.

FOR COMPLETE DETAILS on Sheffield FROST-WHITE-X shields or sheets for vacuum forming, contact your nearest Sheffield representative or write, wire or 'phone Sheffield Plastics Inc., Section 75-B, Sheffield, Mass.

Precision Engineered Rigid Plastic Extrusions

*Trademark **Pats. applied for

SHEFFIELD PLASTICS INC.
SHEFFIELD, MASS.

Don't let dust hijack
50% of your customer's light

Squint the Light Pirate blows high, blows low. But he prefers out-of-reach objects—like fluorescent tubes and fixtures. Studies show that in the space of a year Squint's dirty-dealing can slice a lighting level in half and blackmail your customer or client into paying unexpected maintenance costs.

Here's a plan for outfoxing Squint—a plan you can suggest to a customer when you make your lighting recommendations.

Tell him to call in a local *lighting maintenance contractor*. These experts will set up a cleaning, replacing and trouble-shooting schedule. They report at a time when they won't be in the way. By supplying all tubes and parts, they spare your customer a purchasing and storage problem. And they work with specialists' speed and sure-handed experience.

Doesn't your customer deserve all the light you give him—all the light he's paying for? Show him our *free booklet* on economical lighting maintenance. Write to: NALMCO, P.O. Box 1203, Cedar Rapids, Iowa.

NATIONAL ASSOCIATION OF
LIGHTING MAINTENANCE CONTRACTORS

(*Continued from page* 49A)

GOLDEN GATE SECTION

Members:
Bentley, C. E., Consulting Engineer, San Francisco, Calif.
Krieger, C. H., Consulting Electrical Engineer, San Francisco, Calif.
Wissing, C. H., Graybar Electric Co., Inc., Fresno, Calif.

Associate Members:
Jones, D. W., Joslyn Pacific Co., San Francisco, Calif.
McAdoo, J. L., Pacific Gas & Electric Co., Richmond, Calif.
Roos, Ann M., Bayha Weir & Finato, San Francisco, Calif.

HAMILTON ONTARIO CHAPTER

Member:
Moes, G., Consulting Engineer, Burlington, Ont.
Howard, R. T., Curtis Lighting of Canada, Ltd., Leaside, Toronto, Ont.
McMullan, J. R., James R. Kearney Corp. of Canada, Ltd., Guelph, Ont.

HEART OF AMERICA SECTION

Associate Members:
Courtney, W. R., St. Joseph Light & Power Co., St. Joseph, Mo.
Edds, G. J., Empire District Electric Co., Joplin, Mo.
Scaletty, W. F., Graybar Electric Co., Inc., Kansas City, Mo.

IOWA SECTION

Member:
Ford, E. H., Iowa Electric Light & Power Co., Cedar Rapids, Iowa.

Associate Members:
Halbmaier, G. J., Westinghouse Electric Supply Co., Waterloo, Iowa.
Petersen, D. W., Crescent Electric Supply, Davenport, Iowa.
Plotz, Leo, Crescent Electric Supply, Cedar Rapids, Iowa.
Stone, P. C., Black Hawk Electric, Waterloo, Iowa.

MICHIGAN SECTION

Member:
Squillace, S. S., Hyde & Bobbio, Inc., Detroit, Mich.

Associate Members:
Barkley, J. R., General Electric Supply Corp., Detroit, Mich.
Bedell, Lester, Genesee Electric Co., Flint, Mich.
Block, Saul, Block Bros., Detroit, Mich.
Fenn, J. W., General Electric Co., Detroit, Mich.
Furman, Arkady, C. L., Toonder & Associates, Detroit, Mich.
Masi, Peter, Carroll Sales Co., Detroit, Mich.

MID SOUTH CHAPTER

Member:
*McMullen, H. G., Memphis Light, Gas & Water Division, Memphis, Tenn.

MILWAUKEE SECTION

Associate Member:
Hansen, W. H., Electro Silv-A-King, Milwaukee, Wis.

MISSISSIPPI CHAPTER

Associate Member:
Bean, F. B., General Electric Supply Co., Jackson, Miss.

NEW ENGLAND SECTION

Associate Members:
Bush, J. D., Wheeler Reflector Co., Boston, Mass.
Gaysunas, R. E., Westinghouse Electric Corp., Boston, Mass.
McCormick, R. J., Blackstone Valley Gas & Electric Co., Pawtucket, R. I.
Mullen, Jay, Dennison Mfg. Co., Framingham, Mass.
Musler, G. T., Instrument Development Laboratories, Inc., Attleboro, Mass.
Stockman, T. M., Stone & Webster Engineering Corp., Boston, Mass.

NEW ORLEANS SECTION

Member:
Forrest, J. I., Chesson, Forrest & Holland, Baton Rouge, La.

Associate Members:
Barron, O. E., Jr., Electro Silv-A-King Corp., New Orleans, La.
Hernandez, J. L., Benjamin Electric Mfg. Co., New Orleans, La.
Tannehill, A. W., Lighting Fixture & Electric Supply Co., Inc., New Orleans, La.
Tachirn, E. R., New Orleans Public Service Co., New Orleans, La.

NEW YORK SECTION

Members:
Johnson, C. R., The Port of New York Authority, New York, N. Y.
*Thorington, Luke, Duro Test Corp., North Bergen, N. J.
Associate Members:
Manni, S. A., Duro Test Corp., North Bergen, N. J.
**Vitale, J. T., The Port of New York Authority, New York, N. Y.

NORTH TEXAS SECTION

Member:
*Owen, C. E., Texas Electric Service Co., Wichita Falls, Texas.
Associate Members:
Campbell, M .E., Columbia Electric Co., Inc., Dallas, Texas.
Clayton, W. J., Texas Power & Light, Irving, Texas.
Coker, Sam, Texas Electric Service Co., Midland, Texas.
Graves, O. C., Texas Electric Service Co., Big Spring, Texas.
Moore, E. R., Moore Electric, Dallas, Texas.
Payne, Lucile A., Payne Associates, Dallas, Texas.
Sickler, G. W., Jr., George W. Sickler Co., Dallas, Texas.

NORTHWESTERN OHIO SECTION

Associate Members:
Gibson, N. S., Samborn, Steketee & Associates, Toledo, Ohio.
Harms, G. B., Preeter Electric Inc., Toledo, Ohio.
Knurek, J. S., Westinghouse Electric Supply Co., Toledo, Ohio.
Lobert, Alvin, Romanoff Electric, Toledo, Ohio.

OTTAWA SECTION

Associate Member:
Johnston, W. H., The Holophane Co. Ltd., Toronto, Ont.

PANHANDLE CHAPTER

Members:
Goodson, B. F., Texas Technological College, Lubbock, Texas.
Roberts, J. F., Sr., Zumwalt & Vinther, Lubbock, Texas.
Waghorne, A. C., Consulting Engineer, Lubbock, Texas.
Williams, Ira, Texas Technological College, Lubbock, Texas.
*Laird, H. E., Southwestern Public Service Co., Plainview, Texas.
Associate Member:
DeWitt, T., The DeWitt Co., Lubbock, Texas.

PHILADELPHIA SECTION

Associate Members:
Knickerbocker, Nancy, Philadelphia Electric Co., Philadelphia, Pa.
Linn, Harry, Jr., Wm. L. Long Co., Inc., Media, Pa.
Pierpont, Robert, Atlantic City Electric Co., Atlantic City, N. J.

ROCHESTER SECTION

Associate Member:
Leavitt, P. F., Gerber Products Co., Rochester, N. Y.

ST. LOUIS SECTION

Associate Member:
McKee, H. J., Glasco Electric Co., St. Louis, Mo.
Murphy, D. F., Sylvania Electric Products Inc., St. Louis, Mo.

ST. MAURICE VALLEY CHAPTER

Associate Members:
Aubin, Florian, Canadian Westinghouse Electric Supply Co., Trois Rivieres, Que.

(*Continued on page 52A*)

All This . . . and Fixtures Too!

Remember the story of the little manufacturer of fluorescent lighting fixtures who became a big manufacturer, simply by making the very best fixtures possible . . . selling them at the most reasonable prices . . . and then following up with service, service, SERVICE? Well, like most American success stories, this one has a sequel.

This same manufacturer has practically become a traveling showman. He and his staff have learned a few jokes . . . do a few card tricks . . . make speeches . . . and would probably do a soft shoe routine if anyone pushed them hard enough. They've got a traveling display that's real "doozie!" Miniature sets that show the old-style office vs. the new (with emphasis on lighting, of coures.) Miniature fixtures that show at a glance the best-selling features of the L & P line. Break-aways that make clear — even to your Aunt Minnie — what makes a good fluorescent *good.*

And what a hit at sales meetings. (No, not Aunt Minnie — the displays!) Not only electrical wholesalers, but architects, engineers and contractors as well have praised the show with such purple prose as "Dramatic" . . . "exciting" . . . "stimulating" . . . and, most glowing of all: "most wonderful show I ever saw!" (We admit that last one came from a seventeen-year-old attending his first sales meeting.)

What's the purpose of all this? To show how good L & P fixtures are, of course. To help our representatives and their customers, naturally, And — oh yes (we knew there was a third reason) to sell more L & P fixtures.

How's it working? Marvelously! So well, in fact, that we've decided to offer the services of our L & P displays, promotional material and sales staff to ____(you)____. If you're interested, why not call, wire or write us today?

LIGHT & POWER UTILITIES CORP.

"Put Your Business in a Better Light"

1035 FIRESTONE BLVD. MEMPHIS, TENNESSEE

JAckson 5-0121

Low bay...

or high bay...

Improve lighting, reduce eye fatigue with Abolite uplight fixtures

Only a *small* amount of light (18%) is directed upward through the open top of Abolite uplight fixtures, but it makes a *big* difference in both high bay and low bay installations. Dark ceiling shadows are washed away—there's no sharp contrast of bright light against black background. Eye fatigue is reduced—workers are more efficient. Air circulation through the open top fixture sweeps the reflecting surfaces clean, keeps maintenance at a minimum.

There are three Abolite uplight units: 18" and 24" diam. Alzak fixtures for use with 400 and 1000 watt mercury lamps; 18" Alzak fixtures for 500 watt incandescent lamps. For full details, write *Abolite Lighting Division, The Jones Metal Products Co., West Lafayette, Ohio.*

INSTALLATION DATA

Top picture: 24" Abolite Alzak aluminum fixtures with H-400-watt RC1 color-improved mercury lamps. 18' mounting height, spaced 13' 4" by 16' 8". 60 foot-candles average initially.

Bottom picture. 24" Abolite Alzak aluminum fixtures with H-400-RC1 color-improved mercury lamps. 28' mounting height, spaced on 20' centers. 35 foot-candles average initially.

ABOLITE *Lighting*

(*Continued from page 51A*)

Lemay, Dominique, The Shawinigan Water & Power Co., Shawinigan Falls, Que.

SAN JOSE CHAPTER

Associate Member:
**Levin, R. E., Stanford University, Stanford, Calif.

SOUTHERN CALIFORNIA SECTION

Member:
Johnson, G. L., Randolph & Johnson, Long Beach, Calif.

Associate Members:
Barker, W. L., Consulting Electrical Engineer, Los Angeles, Calif.
Bauman, G. P., L. D. Black & Associates, Los Angeles, Calif.
Thompson, L. T., Jr., Ruby Lighting Corp., Los Angeles, Calif.

SOUTHERN COLORADO CHAPTER

Associate Member:
Bruno, Jack, Pueblo Electric Supply Co., Pueblo, Colo.

TENNESSEE VALLEY SECTION

Associate Members:
Bull, R. W., General Electric Co., Nashville, Tenn.
Mimms, M. L., Benjamin Electric Mfg. Co., Chicago, Ill. (754 Richfield Dr., Nashville, Tenn.)
Shields, W. H., Tri State Roofing Co., Nashville, Tenn.
Smitter, H. E., Graybar Electric Co., Inc., Bristol, Tenn.

TORONTO SECTION

Member:
*Girard, W. H., The Hydro Electric Power Commission of Ontario, Toronto, Ont.

Associate Members:
Dunsmore, O. G., D. H. Howden Ltd., London, Ont.
Lappage, J., Pittsburgh Reflector of Canada, Ltd., Toronto, Ont.
Rawlings, G. E., S. G. Chipman & Co., Ltd., London, Ont.

TWIN CITY SECTION

Associate Members:
Benson, L. M., Northern States Power Co., Minneapolis, Minn.
Daugherty, E. E., Northern States Power Co., St. Paul, Minn.
Erdmann, R. K., Ellerbe & Co., St. Paul, Minn.
Hagstrom, D. S., Ellerbe & Co., St. Paul, Minn.
Harrington, J. K., National Electrical Contractors Assn., Minneapolis, Minn.
Johnson, W. R., Northern States Power Co., Minneapolis, Minn.
Hegerle, R. J., Northern States Power Co., Minneapolis, Minn.
Lavan, J. W., Fleming & Associates, Inc., Minneapolis, Minn.
Marshall, W. J., Northern States Power Co., St. Paul, Minn.
Reiland, J. E., Hackner, Schroeder & Associates, Inc., La Crosse, Wisc.
Sletterdahl, R. A., Jewell Electric, Minneapolis, Minn.

WESTERN MICHIGAN SECTION

Member:
Lake, W. H., William H. Lake & Associates, Muskegon, Mich.

Associate Member:
Rogers, L. E., Industrial Electric Wholesale Supply, Battle Creek, Mich.

WINNIPEG CHAPTER

Associate Members:
Buckler, V. S., Green, Blankstein, Russell & Associates, Winnipeg, Man.
Mooibroek, F., W. L. Wardrop & Associates Ltd., Winnipeg, Man.
Thorsteinson, Eric, Green, Blankstein, Russell, & Associates, Winnipeg, Man.

EMPLOYMENT OPPORTUNITIES

LIGHTING SALES REPRESENTATIVE

To call on architects, engineers, wholesalers, contractors, etc. Complete line of commercial and industrial fluorescent and incandescent lighting equipment sold through electrical wholesalers only. Progressive sales and advertising policy; commission basis. Some areas still open. Furnish complete resume including lines now carried. General Lighting Products Co., 468 Frelinghuysen Avenue, Newark 12, N. J.

LIGHTING DESIGNER

Wide experience in traditional and contemporary church lighting and other public building work. Complete lighting schemes, presentation drawings and statistical build-up to the point of sale. Part time or free lance on a continuing basis. Address Box 324, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

POSITION WANTED

Sales Manager. Young man, lighting engineer. Extensive background in sales; design and engineering; specification; government sales and requirements; advertising and promotion; R. & D. applications. Hiring, training and supervising of sales personnel. Address Box 325, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

LIGHTING SALES ENGINEERS

N. Y. manufacturer desires lighting sales engineers with following among architects, engineers, distributors, etc. Quality line of commercial and institutional lighting fixtures. Holophane licensee. National distribution. Many territories open. Forward complete resume. State lines now carried. Solux Corp., 58-17 - 28th Ave., Woodside 77, L. I., N. Y.

MANUFACTURERS REPRESENTATIVES

Seeking representatives, expanding our line and territories. Considered one of the most progressive in the commercial, industrial and institutional fields. RLM members, Holophane licensees, diversified fluorescent and incandescent line competitively priced. Territories that are open upon request only. The caliber of representatives considered will be only those who call on architects and engineers as well as distributors and contractors. Address Box 327, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y.

REPRESENTATIVE AVAILABLE

Lighting sales engineer with outstanding sales record desires quality lines in Southern Illinois-St. Louis area. Address Box 328, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y.

Watch these columns for opportunities in our expanding lighting industry! Help wanted or lighting people available. You will find it well worth your time!

WANTED — MANUFACTURERS' REPRESENTATIVE

Aggressive man calling on distributors, architects and engineers. Competitive incandescent line of residential and commercial lighting. Excellent opportunity for agent now carrying fluorescent line. Some territories in Midwest and Northwest U.S. and Chicago now open. Give exact territory covered and lines handled. Address Box 326, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

LIGHTING SALES REPRESENTATIVES

To call on Architects, Engineers, Wholesalers, etc. Complete line of Specification Quality Commercial and Industrial Fluorescent and Incandescent Lighting Equipment. Many territories open; good commission; forward complete resume, stating lines now carried.

Sta-Brite Fluorescent Mfg. Co.
3550 N.W. 49th St.
Box 291 Riverside Sta.
Miami, Fla.

FIELD SALES MANAGER

Large fluorescent lighting fixture manufacturer located northeast Atlantic seaboard area requires high-caliber individual to coordinate activities of its sales agents throughout the country.

Administrative and management background essential. Experience in fluorescent lighting highly desirable, but related experience acceptable. Good educational background necessary, preferably college graduate in marketing or sales administration. Age between 30 and 45. This is a highly responsible position where considerable initiative and ability are required. Excellent pay, other benefits and opportunity for advancement. Send detailed resume. Box 323, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y.

SPECTRA®

brightness spot meter

model **C-3**

Battery Operated

Direct Reading
Extreme Sensitivity
Locking Microammeter
Focusing—4 ft. to ∞
3° Angle of Acceptance

other models available for greater sensitivity

All operators will obtain the same reading of the brightness of a given area.

SPECTRA METER NOW USED BY

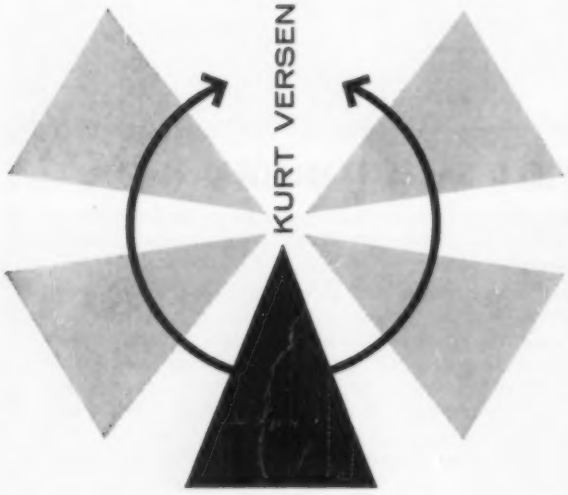
• lighting engineers • aircraft industry • electric utilities • human engineering • architectural firms • motion pictures & TV • high speed photography • still photography • street & highway departments • model work special computer for photography also available.

Write for descriptive literature, complete specifications and information applying to your particular field to:

PHOTO RESEARCH CORP.

837 NORTH CAHUENGA BOULEVARD • HOLLYWOOD 38, CALIFORNIA
Telephone HOllywood 2-6674 *Cable Address: SPECTRA*

KURT VERSEN SWIVEL LINE



Kurt Versen swivel units meet specialized needs for general illumination and dramatic highlighting. The patented Uni-Versen swivel allows wrist-like movement with finger-tip pressure, and *holds* position till moved. Wide selection of mountings, reflector shapes and finishes. All built to institutional specifications for faithful service, yet priced among the lowest.

Write for catalog.

kurt Versen COMPANY

contemporary lighting

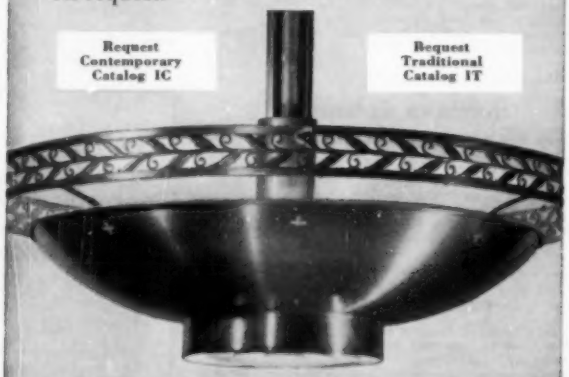
Englewood 29, N. J

Tremendous Selection

of correlated lighting in matched sets for churches and institutions. Select from traditional or contemporary design, request special design service if necessary. Catalogs on request.

Request Contemporary Catalog IC

Request Traditional Catalog IT



R.A. MANNING CO.

BOX 643 SHEBOYGAN, WIS.

INCONSPICUOUS

LIGHT SOURCE

The beautiful unadorned lines of Wiley's new Zephyrs harmonize so well with any decor that you're unaware of the source of light. Their wafer-like thinness makes them ideally suited to installations where recessed fixtures cannot be used. Available: 2 and 4 lamps; variety of shielding devises, solid or plastic sides.

PLASTIC GRID

No. 70 GLASS

REVERSE PYRAMID

R&W WILEY Pioneers in Fluorescent Lighting

Dearborn & Bridge Sts., Buffalo 7, N.Y.

INDEX TO ADVERTISERS
December 1957

Abolite Lighting Division Jones Metal Products Co.	52A
Advance Transformer Co.	1A
Bakelite Company, Div. of Union Carbide Corp.	35A
Braseolite Incandescent Div. Edwin F. Guth Co.	41A
Certified Ballast Manufacturers	27A
Champion Lamp Works	46A
Corning Glass Works	28A-29A
Curtis Lighting Inc.	5A
Day-Brite Lighting Inc.	6A
Eastern Fixture Co.	56A
Fluorescent Fixtures of California	33A
General Electric Co., Lamp	43A
Edwin F. Guth Co.	Back Cover
Jefferson Electric Co.	21A
Kopp Glass Inc.	16A
Koppers Company Inc.	39A
Light & Power Utilities Corp.	51A
Lighting Products Inc.	47A
Litecontrol Corp.	22A
R. A. Manning Co.	54A
McPhilben Lighting Co.	25A
Metalcraft Products Co. Inc.	48A
National Association of Lighting Maintenance Contractors	50A
Perfeclite Company	19A
Photo Research Corp.	53A
Piolite Div. Pioneer Plastics	55A
Pittsburgh Reflector Co.	38A
Revere Electric Mfg. Co.	42A
RLM Standards Institute	Inside Back Cover
Rotuba Extruders Inc.	36A
Sheffield Plastics Inc.	49A
Sola Electric Co.	13A
Starring & Company Inc.	2A
Sunbeam Lighting Co.	10A-11A
Sylvania Electric Products Inc.	4A, 15A
Kurt Versen Company	54A
John C. Virden Co.	37A
Wakefield Company	Inside Front Cover
Westinghouse Electric Corp., Lamps	31A
Westinghouse Electric Corp., Lighting	40A
R. & W. Wiley Inc.	54A
J. A. Wilson Lighting & Display Inc.	44A-45A

new way to assure perfect illumination . . . specify formed

VINYL Light Diffusing PANS

*available from leading fixture manufacturers **

Formed Vinyl Light Diffusing Pans offer many advantages over all other commonly-used shielding materials. More and more manufacturers are using these Pans in their lighting fixtures. Here are the reasons why:

UNIFORMITY. Chief among these is the fact that formed Vinyl Pans are completely uniform — assuring even light transmission over flat and curved areas. Uniformity as to color is also assured. Formed Vinyl Pans show *no change in color* after many years of service.

SAFETY. Formed Vinyl Pans are UL-listed for use under sprinklers. They will not support combustion, and will soften and fall out well in advance of sprinkler release temperature of 165°F.

COST ADVANTAGES. Expensive dies are eliminated by the forming process and an almost limitless number of designs can be produced with extreme economy.

new! **FREE** miniaturized **SAMPLES** of formed **VINYL** light diffusing pans

See for yourself! Check the uniformity of light transmission and color, the typical designs possible, in these 4 miniaturized sample Pans. Simply fill out and attach coupon below to your letterhead to request these free samples.

**Complete list of fixture manufacturers offering formed Vinyl Pans available.*

Piolite Division Pioneer Plastics 28 Howley Street, Peabody, Mass.

☐ Please send me the 4 miniaturized samples of formed Vinyl Light Diffusing Pans, and a listing of fixture manufacturers who offer Pans of this type.

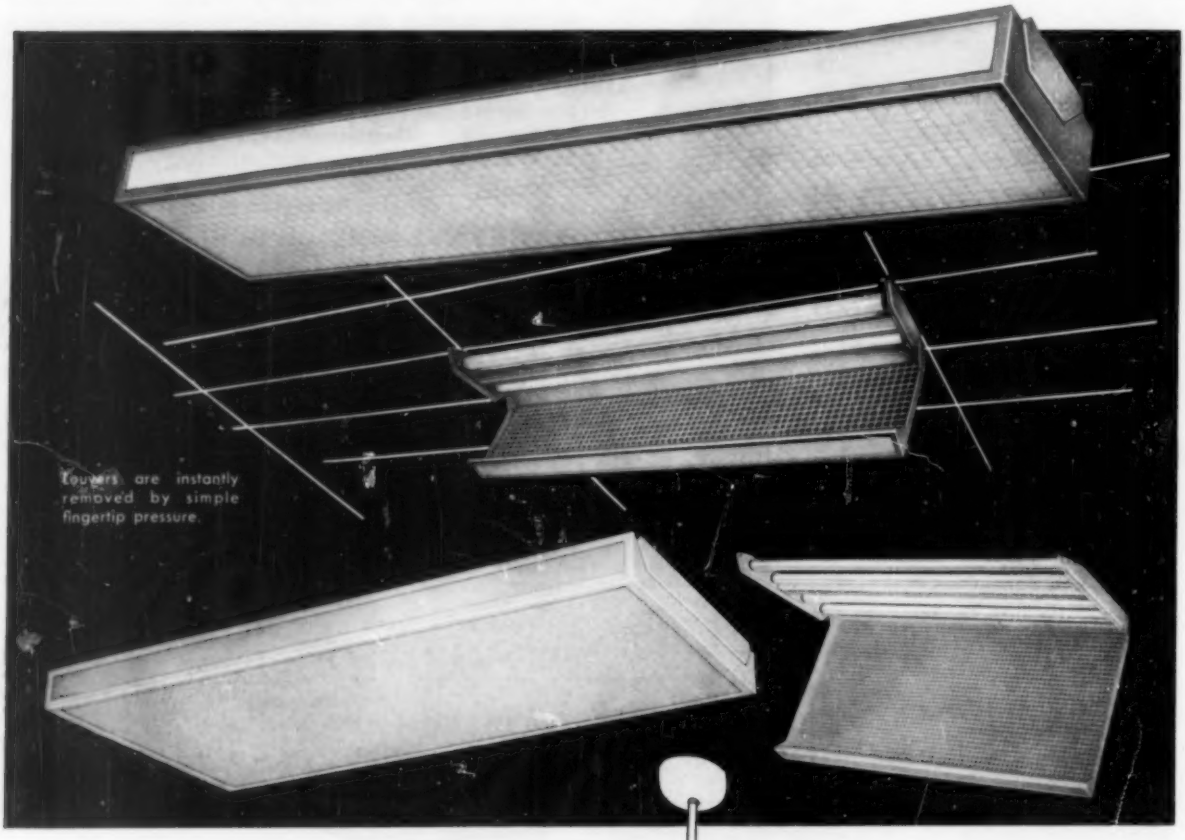
name _____ title _____

company _____

address _____

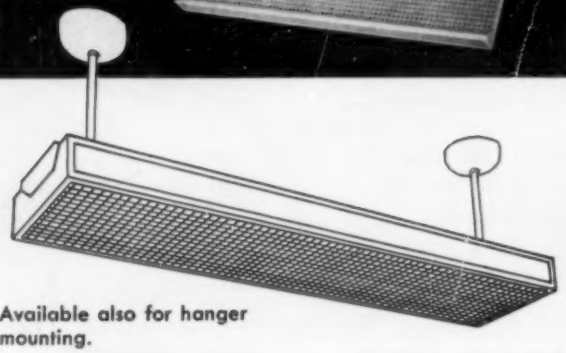
city _____ state _____

EASTERN'S NEW
CAMBRIDGE SERIES
Sleek – Shallow – Economical to Install and Maintain



Another great achievement by Eastern — the brilliantly styled, clean-cut, new Cambridge series. Designed for every type of installation, these "thin man" 3¾" fixtures can be surface mounted to ceiling, suspended on hangers, or installed in continuous rows. Sides and louver lower as single unit to make maintenance easy. Slotted type reflectors — an Eastern exclusive — provide peak lighting efficiency upward and downward.

In 4′ and 8′ lengths, 12″ and 24″ widths, for 2 and 4 fluorescent rapid start or slimline lamps. Also for eight 40-watt rapid start lamps in tandem 42° x 42° shielding.



Available also for hanger mounting.

EASTERN FIXTURE CO.
170 VERNON STREET, BOSTON 20, MASS.

EASTERN FIXTURE CO.
170 Vernon Street, Boston 20, Mass.

Please send complete details on your new Cambridge series of fluorescent rapid start and slimline fixtures:

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

these are the manufacturers who offer RLM-labeled units...

1,000 Words of Specifications

are back of every RLM®-labeled industrial lighting unit!

The power of over 1,000 words of highest-in-history RLM lighting specifications is behind every RLM-labeled unit. Each word is in accord with basic, nationally-accepted, minimum standards for industrial lighting equipment efficiency, design and performance. RLM-labeled units conforming to these specifications are available from the leading manufacturers shown in the chart above. While each RLM Unit meets certain minimum RLM Standards, other special features, such as construction refinements or operating advancements, vary from unit to unit according to the ideas and skill of the individual manufacturer. For example, the RLM Label may be affixed to as many as 960 different types of RLM Dome Reflectors! Send for your complimentary copy of the 1957 RLM Specifications Book, containing a complete set of RLM Specifications.

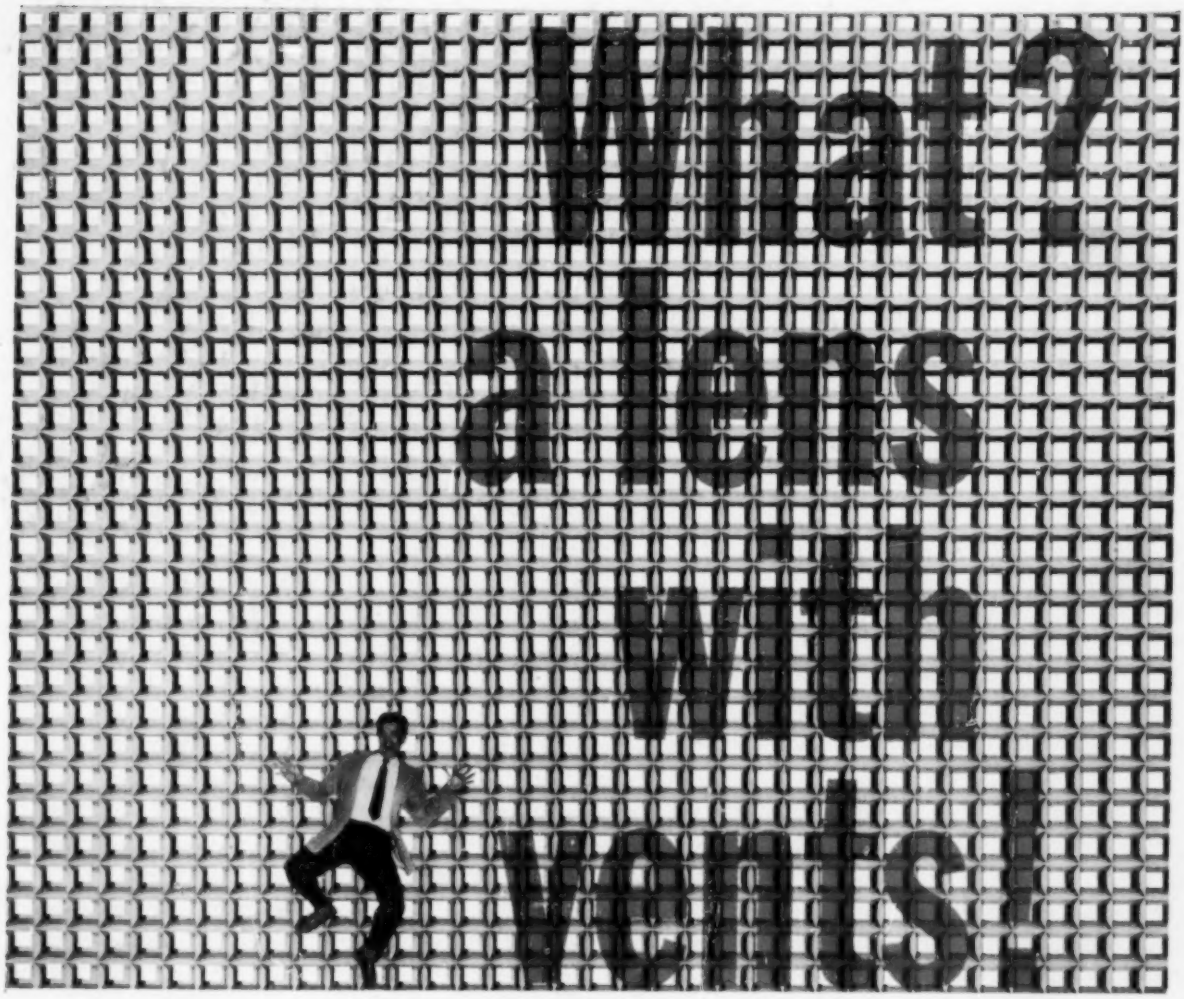
RLM STANDARDS INSTITUTE, Suite 823, 326 W. Madison St., Chicago 6, Ill.

Reg. U. S. Pat. Office

RLM STANDARDS INSTITUTE
INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

R-1553 R



ballast men are amazed about Guth Prismoid-GrateLite*

When a recent visitor to our plant saw a section of the new Guth Prismoid-GrateLite lying flat on white paper, his eyes sparkled.

He held it up and exclaimed, "It's great! It's got holes!"

Our visitor was a ballast salesman, and he was mighty happy that the gorgeous new Prismoid has holes. As he explained, almost everyone is enclosing ballasts, cooping up the heat, cutting down fixture depth... making it tougher than ever for ballasts to serve their legitimate lives.

But here is Prismoid, a prismatic louver-lens *with holes!* The ballast salesman said, "It's certainly a step in the right direction!"

Thanks to Prismoid's *breathing action* ballasts get ventilation, lamps are cooled and the flowing air helps keep lamps, Prismoid and fixtures up to 50% cleaner than solid panels.

Guth

PRISMOID
• GRATELITE
The Prismatic Louver-Lens

*T. M. Reg. U. S. & Can. Pats. Pend.

THE EDWIN F. GUTH COMPANY • ST. LOUIS 3, MISSOURI
TRUSTED NAME IN LIGHTING SINCE 1902